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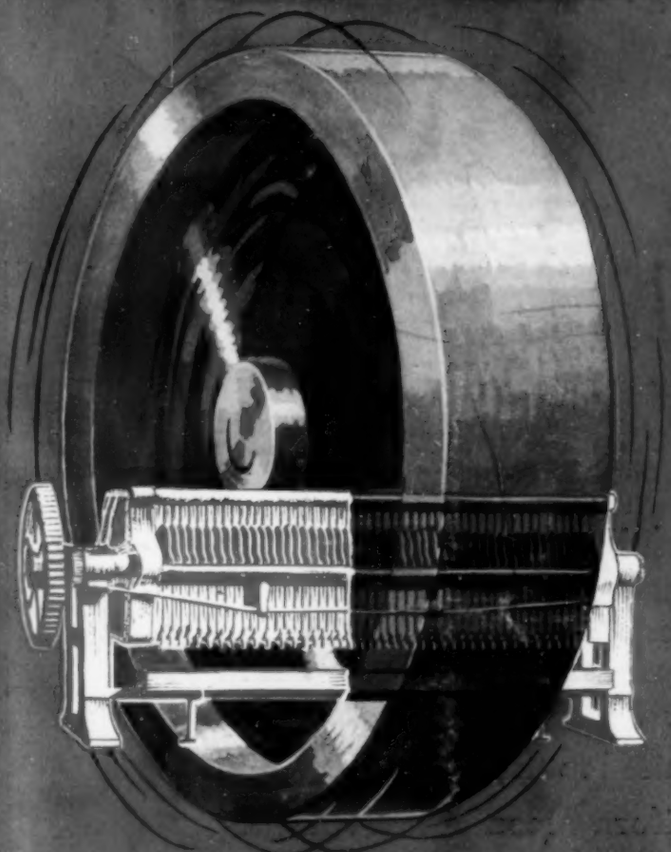

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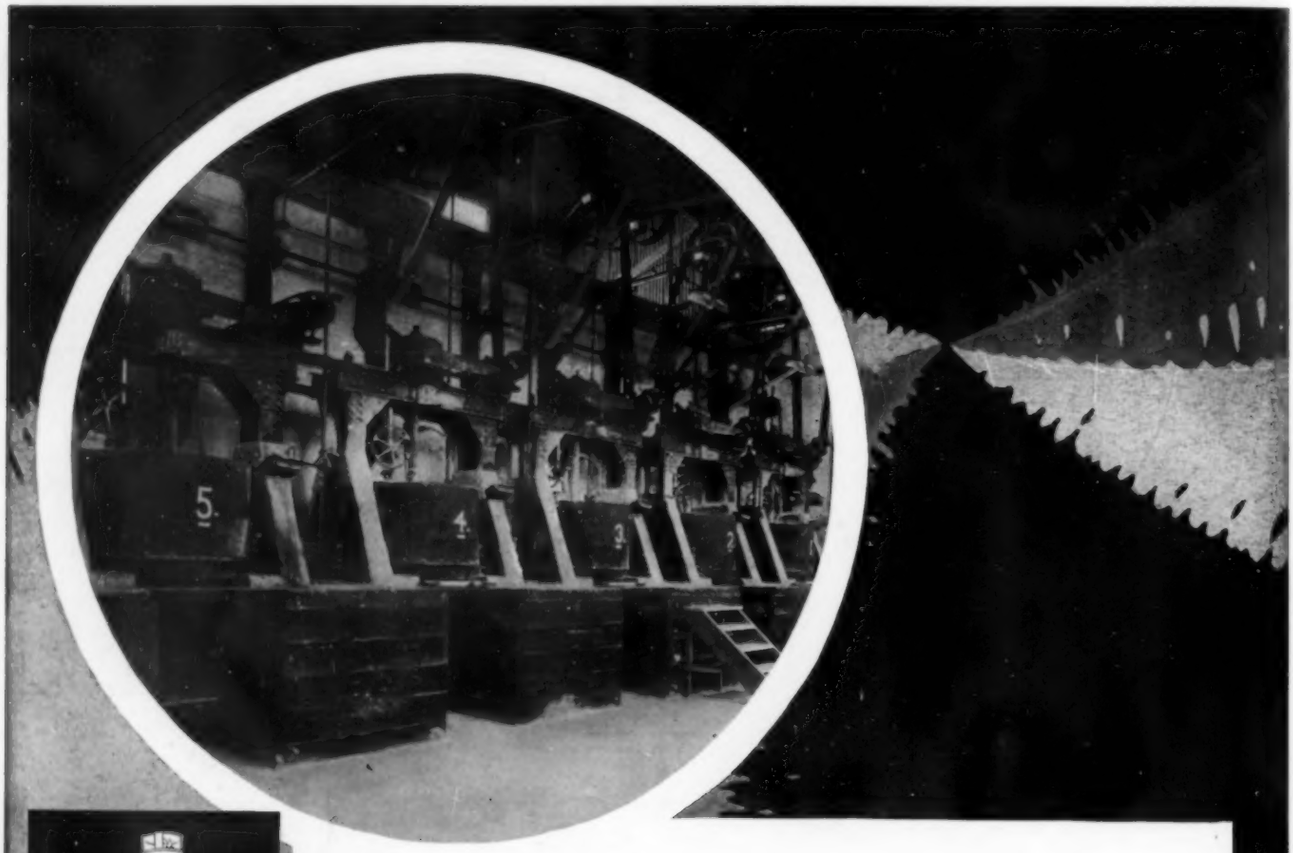

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CHEMICAL & METALLURGICAL ENGINEERING

VOLUME THIRTY-FIVE - NUMBER TEN

OCTOBER, 1928

McGRAW-HILL PUBLISHING COMPANY, INC. - JAMES H. McGRAW, *President* - EDWARD J. MEHREN, *Vice-President* - H. C. PARMELEE, *Editor*

Industry's Responsibilities for Safe Practice

OF MANY responsibilities peculiar to chemical engineering industry, none is more serious than that for safety. A chemical manufacturer can, with the assent of his stockholders, risk his plant or physical equipment in any undertaking that promises a legitimate profit, but just as soon as his gamble involves the possible loss of a single human life, he violates a sacred obligation of his industry. To conserve human equipment is not a purely altruistic purpose; it is good business. It pays dividends in reducing labor turnover and interrupted operations. A definite relation exists between accident prevention and increased production which many industries have discovered to their own advantage.

CHEMICAL INDUSTRY bears a relation to the general public that carries with it another responsibility. Many chemical products are inherently dangerous unless the user is aware of their properties, and of proper means of safeguarding their handling. When the chemical manufacturer introduces a new material, whether in the form of a fire extinguisher, a rubber accelerator, or a new motor fuel, he is under an obligation to make certain that his product carries no preventable hazards for the uninformed user. In the manufacturer's research, provision against the misuse of a new material is almost as important as is its efficacy in the use for which it is intended. It is better to have invested heavily in such a study than later to pay the price in indemnities and the loss of good will that result from unfortunate experiences in the hands of the customer.

ONLY TEN per cent of industrial accidents, it is reported, can be prevented by mechanical safeguards. The ninety per cent which are the result of some form of human failure emphasize the importance and necessity for educational work. It is not sufficient merely to warn the employee that his own interest demands safety in his work. The admonition must be backed up with fundamental reasoning. Accident prevention becomes second nature to the man who understands the consequences of careless operation.

CHEMISTS and engineers have peculiarly important parts in this educational process. They know, perhaps better than anyone else, the actual hazards involved in projecting a new process from the laboratory to plant operation. Their technical knowledge, translated into safely designed equipment and sound operating practices, is an industry's best insurance against preventable accidents.

IN ADDITION to its responsibilities to the general public, to the individual user of its product, and to its employees, chemical industry has a responsibility to itself. Manufacturers have a common interest in safety, since any major accident reacts against the entire industry. Safety is its life blood. Chemical industry cannot develop to the fullest extent if handicapped by a reputation for hazardous operations. Its own progress demands that it go beyond the letter of the law and interpret the spirit of safety in every phase of its operations.

Competition From the New Germany

DR. JULIUS KLEIN, one of our keenest observers of economic trends, recently told a group of editors that Germany's spectacular progress was due, in a large measure, to her remarkable organization of chemical industry. The I.G. forms the cornerstone of her entire industrial structure, and on it she is building her plans for the recapture of world markets.

Thus in recent commercial treaties with France and Japan, the German Government has insisted upon several concessions for chemical commodities. On August 15, 1928, Germany's obligations under the London Agreement to deliver dyestuffs on reparation account to various of the allied nations came to an end. This opens the way now for a remarkable drive to increase sales of dyes and chemicals in all foreign markets.

The one problem that is giving German chemical industry most concern is the employment situation, which E. M. Allen competently discussed in the September issue of *Chem. & Met.* Many German chemical industries, in sharp contrast to those in the United States, depend largely on manual operations. Plants have been expanded by duplication of existing units without adequate provision of labor-saving machinery. More than 33,000 persons are employed at Leunawerke, and the I.G.'s total payroll is 143,000. In the past two years there has been a succession of important increases in wages, and the end is not yet in sight. Furthermore, there has been increasing unrest in a number of industries. Three times as many working days were lost by strikes in 1927 as in 1926. It is apparent that German industry can profitably take a leaf from the experience of American manufacturers who have substituted machinery for men and at the same time have permitted the worker to share in the savings thus effected.

But just as Germany has been able to solve other outstanding economic and social problems, it may be expected that the labor situation will eventually be righted. In the meantime, however, those American chemical industries that have put their production and distribution on an efficient basis have little or nothing to fear in the domestic market. In the export trade German competition will be keener, but American products firmly established in foreign markets since the war will not be easily displaced.

Charleston— Chemical Capital?

IF OUR recollection does not play us false, the grammar school geographies that taxed our youthful powers of absorption had little to say of the capital of West Virginia, other than that its setting was, artistically, well nigh perfect, and that it lay in a region rich in coal, oil, gas and salt. Consequently, to many of the two hundred members of the American Electrochemical Society who descended upon Charleston for the semi-annual meeting of the society, it was a pleasing surprise to find that there, tucked away in the wooded hills of West Virginia, lay a region blessed by nature and exploited by man to such a point that Niagara Falls must look to its laurels.

Charleston boasts cheap coal and, hence, power that is low in cost compared with many sections. Its natural gas, apparently far from exhaustion, affords not only fuel but raw materials for making solvents and chemical derivatives. Its electrolytic caustic soda industry, including the largest commercial producer in the world, finds a home market for its chlorine and hydrogen as well as the primary product. The country's second largest direct synthetic ammonia plant is here. Here also are plants for sheet glass and bottles; here are oil refineries using a crude produced nearby and second in quality only to the highest grade Pennsylvania. Paint, barium products, salt and brick are all represented.

Charleston was treated kindly by nature. It remains to be seen how far chemical industry will grasp the opportunities that nature offers.

New Technology for Old in the Kraft Paper Industry

REMODELING of a plant already established requires courage on the part of capital even though the path may previously have been trod by others. But when that rebuilding involves pioneering into an entirely new technology for the whole industry, genuine leadership is required from capital, as well as from the engineers responsible for the accomplishment. The planning of this work in an industry involving such a diversity of unit processes as of the manufacture of kraft paper, with its relatively small spread between cost and selling price, its changing raw materials and strenuous competition, requires a type of foresight that looks beyond the immediate demands of the business.

The manufacture of kraft paper, although a young industry and probably in part developed by accident, presented a rare opportunity for a rebuilding program through the entire change of process and methods. The appropriateness of such a course has been emphasized by the economic opportunity presented in the development of the wood pulp industry of the Pacific Northwest. There one large manufacturer has taken up the gage and the story of his accomplishment is recorded in the pages of this issue of *Chem. & Met.* It is well worth while to stress the remarkable manner in which this program was developed and executed.

Beginning several years before the time set for plant erection, the engineers and executives of the Longview Fibre Company carefully studied the existing kraft process, step by step. Nothing was omitted. Each unit process, each raw material source, even construction methods were thoroughly investigated. Where it seemed desirable that improvement should be effected, specialists were consulted and intensive research was pressed on the economics as well as the technology of the process. Investigation was rapidly carried to pilot plant scale. The study was so complete that it extended to all phases of the raw materials and to all details of process and equipment. This study involved several years' work and was carried out at another mill in Wisconsin.

Having developed the most efficient process, the engineering staff was augmented and a new plant was designed and built. Foresight did not end there, however, but extended to even the minor details of erection. The result has been the actual rebuilding of an industry and its complete modernization. There is something new in every step of the process.

Results showing savings in operating costs, relief from operating troubles, smoothness of initial and continued operation, and plant flexibility have proved the venture worth while. What will doubtless prove of even greater value is the organization developed in carrying out this program.

Conserving Manpower

WHEN a plant manager ignores the inevitable depreciation that undermines his production equipment, the probabilities are that the board of directors will find a new plant manager. When the same manager ignores the depreciation of his personal equipment and fails to provide the same intelligent inspection for his body that he should accord his plant machinery, the eventual action of the board of directors may quite possibly be the same. The ravages of disease take enormous toll of industry, yet how many of us give even a fraction of the thought to the conservation of manpower that we give to the saving of horsepower?

Many of the ailments that have arisen in conjunction with various branches of chemical industry have been brought under control. One scourge, however, that may frequently be of an occupational nature, is reported to be on the increase. Cancer, usually the result of some form of prolonged irritation, be it physical or chemical, is constantly levying a heavier tax on industry. The past fifteen years have witnessed a twenty per cent increase in cancer deaths. In 1927 it caused approximately 110,000 deaths throughout the United States.

Cancer is no respecter of persons. And yet, it is emphasized by the Society for the Control of Cancer that the disease's heavy inroads are in large part preventable. When the tumor is detected in time, the likelihood of recovery is usually excellent. What is needed, therefore, is an alertness on the part of management that will result in frequent medical examinations of industry's manpower. A broken machine part is replaceable—a brain lost to industry may never be duplicated.

A Logical View of Industrial Zoning

IT IS AXIOMATIC that legislative bodies seem to have difficulty in grasping the full significance of legislation aimed at industry. An excellent example is shown in the theory—contrasted with its working out—of zoning ordinances for industrial nuisance regulation. R. D. MacLaurin, Commissioner of Trade Wastes for the city of Cleveland, writing in a recent issue of the *National Municipal Review*, takes a most logical view of zoning, both from the standpoint of its aims and its accomplishments.

"Legislation pertaining to the zoning of industry should at least provide means for realizing its constitutional purpose. The alleged purpose of industrial zoning is to promote health, safety, morals or general welfare. Those are the constitutional grounds empowering municipalities to regulate industry. . . . Yet regulations contemplating the control of nuisance caused by dusts, fumes, odors, noxious gases or offensive water-carried wastes are not incorporated in any zoning legislation yet enacted."

The legislative premise is that industries are nuisances *per se*. And yet Mr. MacLaurin declares "There are no industries which can be scientifically designated as" . . . such. "Nuisance is attributable chiefly to the neglect on the part of industry to apply adequate methods for the purpose of controlling the emission of dusts, fumes, odors, noxious gases or offensive liquid wastes."

Nor does the segregation of industries into groups provide protection for these industries. It is possible, also, that such zoning creates a false sense of security in the minds of manufacturers, whereas, if the truth were realized, the firms may still be violating existing nuisance laws. Protection begins only when the best practical means known to the art have been applied. A nuisance, although segregated and removed from residential districts, is still a nuisance and may prove ruinous to other manufacturers. Zoning laws, in theory at least, are intended to promote the general welfare, which undeniably includes the welfare of industrial as well as residential districts.

It, therefore, appears that zoning laws of themselves do not finish what they begin, for they protect neither industry nor the public in general. What is needed is actual nuisance control. . . . "This can be accomplished by a municipality's requiring that industries shall secure a permit to conduct business. This permit shall not be issued . . . unless the industry shall employ the best practical means known to the art for the abatement of" . . . these various nuisances.

However, it is usually the case in industrial morality that the wages of virtue are increased profits. The use of the best practical means is always an advantage to industry. With one stroke, residential districts may be improved, other industrial interests may benefit and not infrequently, the wastes that were nuisances become an added source of income to the erstwhile offender.

A Precocious Infant Celebrates a Birthday

TWO years ago a new opportunity for the engineering and scientific world came into being at the Carnegie Institute of Technology. Under that institution's auspices the first International Conference on Bituminous Coal was held, so successfully that close to eighteen hundred engineers, scientists and executives saw fit to gather in Pittsburgh while two score of experts best qualified to discuss the several fields of coal utilization assembled from many countries to present the latest in coal technology. The bringing together of such an assemblage was a notable achievement in itself. Still more notable has been the impetus which this free exchange of experience has given to scientific coal processing.

Again the congress has been called together. The second International Conference, meeting once more at Pittsburgh, November 19 to 24, will have a purpose similar to the first but broader in conception. Coal as a raw material will acknowledge coal as a direct fuel, pending the time when more rigid economies will demand universal processing. Emphasis, however, will rest very considerably as before upon the synthesis and distillation bases which recent years have brought to the fore.

Over a hundred speakers will be in attendance, representing Continental Europe, Great Britain, the Far East, Canada and South America in addition to the United States. The list includes such authoritative names as Lord Melchett (Sir Alfred Mond), Rudolph Pawlikowski (the man who operates Diesel engines on powdered coal), Franz Fischer, Friedrich Bergius and Georges Claude. Among those who will uphold our own scientific reputation are numbered S. W. Parr, A. D. Little and E. C. Jeffrey. It needs no seventh son to foresee wide consequences for the second International Coal Conference.

LONGVIEW MILL E
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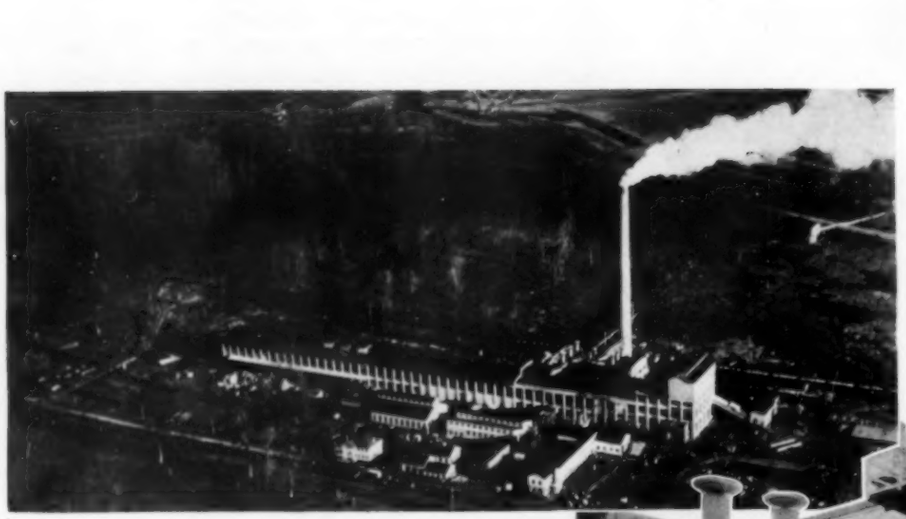
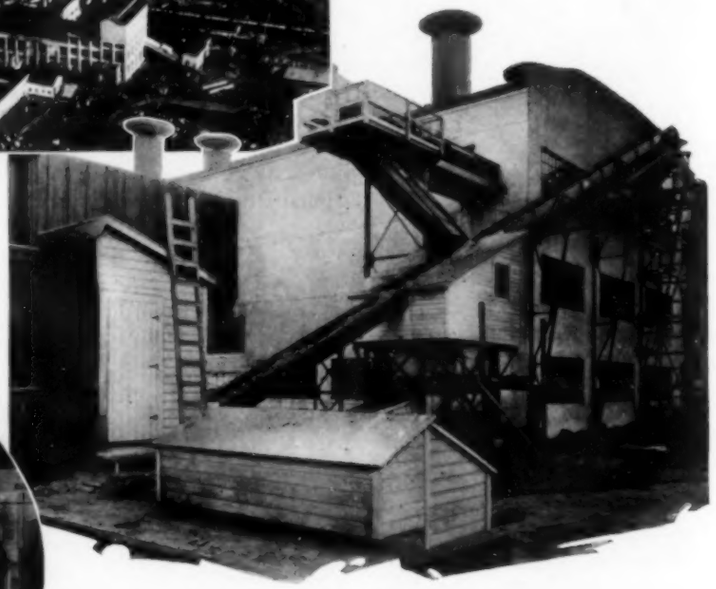
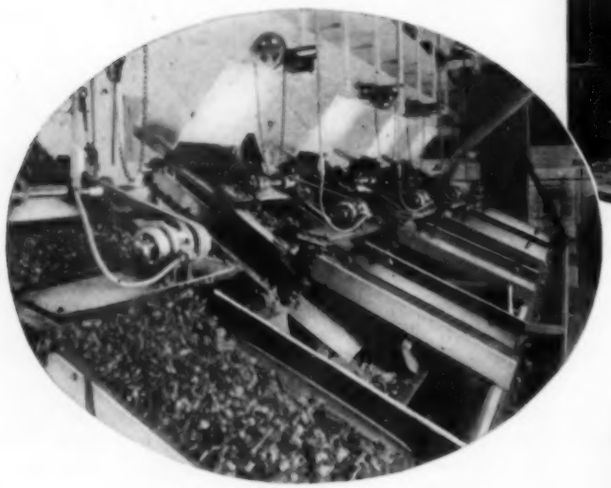


At the left, an airplane view of the Longview Mill. Nearby is the largest lumber mill in the world from which Longview gets its raw material and its fuel

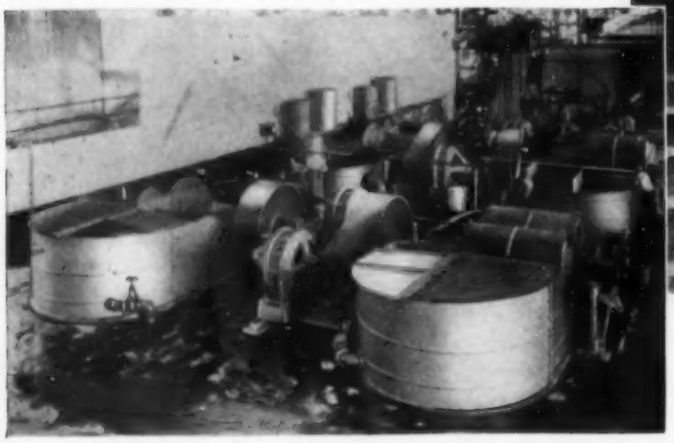


Hog fuel, received in cars such as the one shown on the next page, discharges to the conveyor at the right and is taken to the boilers. Below are the chip screens which size the fir chips used as the raw material



The conveyor below carries chips from the screens to bins prior to digestion. The chips are weighed and sampled on the belt

A general view of the beater room is shown below. The board machine is in the rear and the paper machine out of view at the right



Evolves New Technique Pulp Process

By R. S. Wertheimer

Resident Manager, Longview Fibre Company, Longview, Wash.

WHILE THE FIRST commercial application of the sulphate method of pulping was practiced as early as 1884 in Europe, it was not until 1907 that American manufacturers accepted the process. The early American mills were built and operated by Germans and Swedes who had been instrumental in the development of the art in Europe.

The original process as practiced in Europe remained practically unchanged for a long period, during which time the economic and competitive aspects of pulp and paper manufacture were more and more becoming a factor in the art. Hence, when it became apparent that the change in these conditions called for a revision of the technique employed in the sulphate process, it was deemed expedient to carry out a thorough investigation of the process as employed in order to institute improvements whenever they were needed. To sense the importance of the changes that have developed as the most modern practice it is desirable to study the sulphate process as it was carried out until a few years ago.

Coniferous woods, such as hemlock, spruce, tamarack and the various pines were chipped and then screened to remove the sawdust. Digestion was carried out either in stationary or tumbling digesters under various steam pressures from 90 to 120 lb. The pulp was washed in diffusers as a rule. However, some of the more primitive mills used open blow pits. The spent cooking liquor was first evaporated in vacuum evaporators and then in disk or contact evaporators in which the hot flue gases from the black ash smelters and incinerators supplied the heat. The disk evaporators were followed by rotary incinerators which completed the water removal and produced a water free product consisting of the major portion of the ligneous material in the wood together with the spent cooking chemicals. From the incinerator the resulting black ash was introduced into a smelting furnace together with sufficient salt cake and/or niter cake to make up the process losses. The action in the furnace was one of oxidation of the ligneous and combustible organic material and reduction of the salt cake to sodium sulphide. The carbonate was, of course, melted and, together with the sulphide and a small amount of unchanged sulphate, flowed out of the slanting furnace bottom into a tank of water or a weak caustic solution. The resulting solution, when it reached the proper strength, was called green liquor.

The green liquor was then transferred to the causticizing tanks, where lime was added and the sludge formed in the reaction

$Na_2CO_3 + Ca(OH)_2 \rightarrow 2NaOH + CaCO_3$ was settled out. The clear liquor was decanted and used for cooking and the sludge was washed to remove the caustic. Until recent years it has been the practice to allow the lime sludge to run to waste instead of recovering the lime as is done at present.

An important factor in limiting the development of the kraft industry has been the obnoxious odor, produced in recovery of the spent cooking liquor. This fact has precluded the establishment of plants in thickly settled communities where manufacturing facilities were most suitable and has forced development in isolated places, often with greatly increased capital and operating costs.

The Longview Fibre Company's plant at Longview, Wash., is an example of the modern trend in sulphate mill design. It was necessary that this plant be constructed so as to operate without the usual kraft mill odor; also it was necessary to meet a number of new conditions which are of interest and are described in detail in the following paragraphs.

TAKING UP the various departments in order of the process, first in line comes wood preparation. The Longview mill uses refuse fir wood exclusively in the manufacture of its major product, sulphate test liner. Two chipping plants located at the source of the refuse wood on the Long-Bell Lumber Company's property supply the necessary chips. Two 86-in. Kamyr pressure feed chippers, which were manufactured in Sweden, are installed at each of the two units of the sawmill. These chippers are powered with 150 hp. motors driving through Allis-Chalmers Texrope belts. Sufficient chips are produced here to make 100 tons of finished product per day.

It is interesting to note that all of this refuse is Douglas Fir. This marks the first successful attempt to use fir exclusively for the raw material in sulphate pulping. The chips are conveyed to specially constructed cars of the type shown in Fig. 1, holding approximately 20 "units." The cars are switched daily to the paper mill, which is located about a mile distant from the sawmill. Here they are unloaded and screened preparatory to conveying to the chip bin serving the digesters.

Fig. 1—Car Designed by Longview for Transportation of Chips and Hog Fuel

A somewhat unique system of chip measurement is employed at this plant which eliminates the uncertainty involved in the usual volume measurement due to the size of container used and the amount of moisture in the chips. The basis of measurement in vogue on the West Coast is the so-called "unit" which contains 200 cu.ft. of chips. This volume measure is supposed to be equal to the standard cord of 128 cu.ft. of closely piled wood. The method adopted at the Longview Fibre Company is as follows: The weight of a cord of 128 cu.ft. of bone dry fir refuse wood was accurately determined. An automatic belt weighing device known as the Merrick Weightometer was installed so that all of the chips used in the process pass over it and are weighed. A continuous sampler was also installed on the belt so that a small representative sample of chips is continually extracted. This sample is used to determine the moisture content of chips purchased. The moisture factor applied to the wet weight of the chips as weighed by the weightometer and divided by the bone dry weight of a 128-cu.ft. cord gives the number of cords passed over the conveyor for the interval of time measured. The sawdust and unusable chips rejected in the screening operation are paid for as hog fuel and burned under the boilers.

After the chips are screened and weighed the cooking and washing operations follow. There are four 2,600-cu.ft. stationary digesters, producing about 5½ tons of pulp measured on an air dry basis. These digesters are served by 14 diffusers arranged in two rings of seven each. A swing pipe connects each diffuser in turn with its proper digester. The salient points in this arrangement which differ materially from other kraft mills lie in the blow gas collection and disposal. The condensable gases evolved in the blowing of a digester are condensed in a large surface condenser. The non-condensable gases and condensate are then led to a gas washer, from which

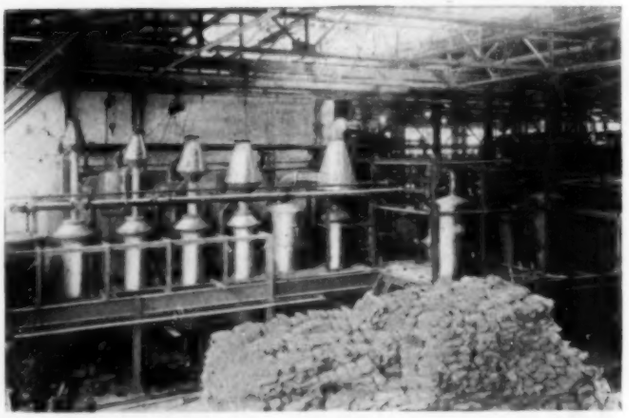


Fig. 2—General View of Peebles Evaporator and Dehydrator Equipment for Black Liquor Concentration
The quintuple effect evaporator is at the left, in series with the double effect dehydrator at the right.

they are removed under pressure to the furnaces. Suitable explosion seals are installed in the pipe line to the furnaces to prevent back firing. In this manner most of the odorous gases are burned and rendered odorless. There are, however, some gases of high solubility and low boiling points which are discharged into the sewer. If the solution containing these gases is kept at a low temperature the gases remain in solution and do not cause a nuisance.

The recovery process installed at Longview was worked out in its entirety at the plant of the Thilmany Pulp and Paper Company at Kaukauna, Wisconsin, prior to the design of the western plant. A 25-ton pilot unit was constructed consisting of a double effect high pressure concentrator, a smelter and a 500 boiler horsepower waste heat boiler. It was definitely determined at this experimental plant that with the method of recov-

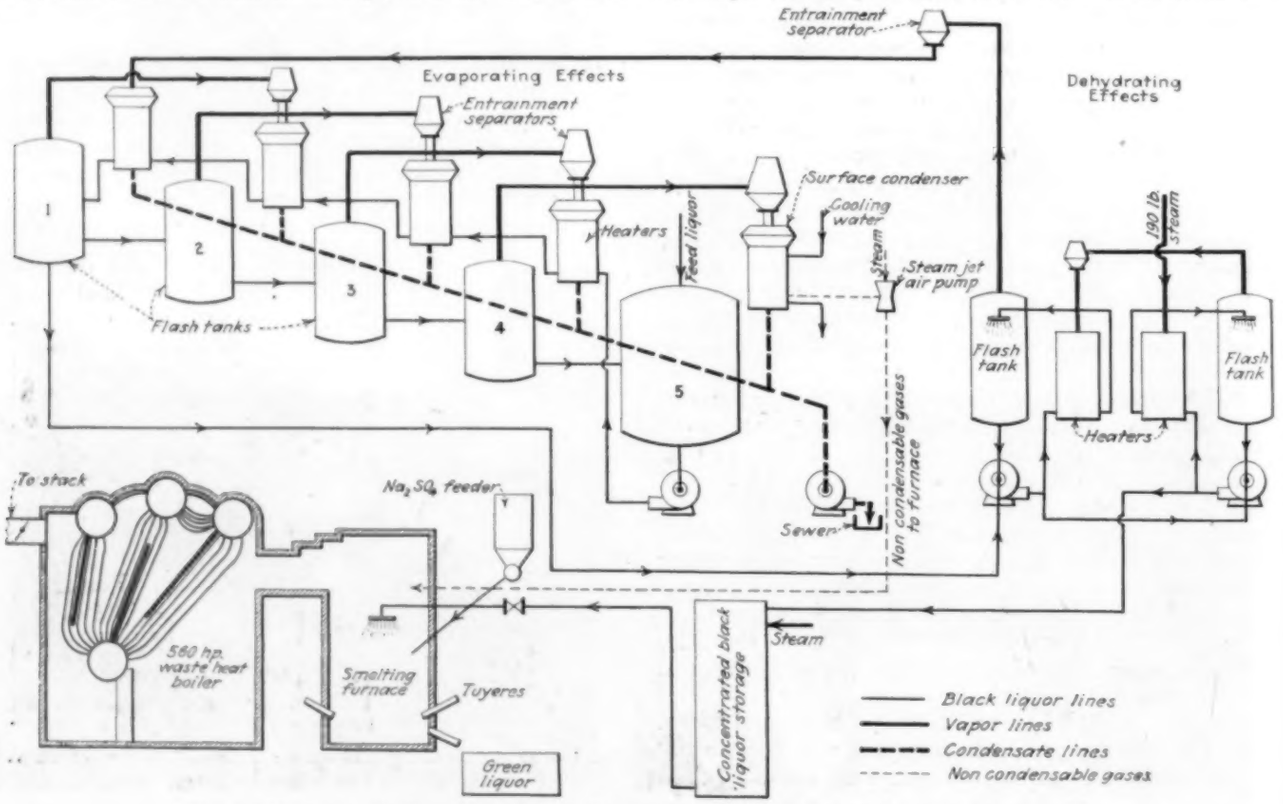


Fig. 3—Diagrammatic Layout of Peebles Evaporator and Dehydrator With Smelting Furnace, Waste Heat Boiler and Auxiliary Equipment

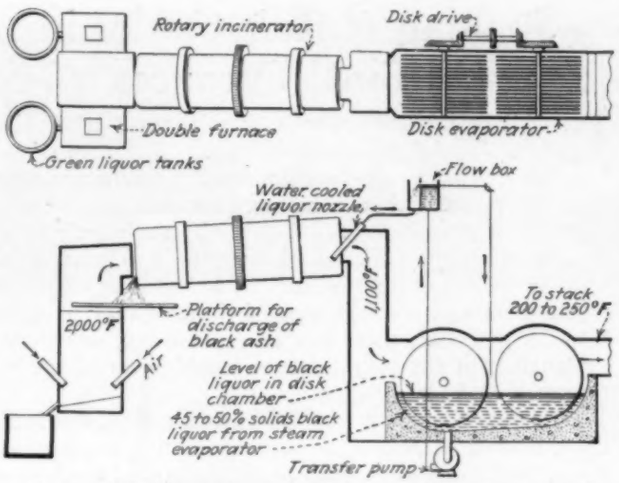


Fig. 4—Disk Evaporator, Incinerator, Smelting Furnace and Auxiliary Equipment Used in the Old Type Black Liquor Recovery Plant

ery evolved and described below the usual sulphate mill odor could be eliminated.

The basic idea underlying the odorless recovery system is the complete combustion of all gases evolved in the process. In order to accomplish this it is necessary to evaporate the spent cooking liquor or black liquor to a degree of concentration which permits combustion to be sustained in the furnace without the addition of a supplementary fuel. Where, in the older type recovery, the black liquor was concentrated by direct impingement of the hot furnace gases, it was found necessary in the odorless process to concentrate the liquor with steam in a closed system, to a point where combustion could take place.

The apparatus evolved to do this concentration (Fig. 2) is a five-effect vacuum evaporator directly connected to a double-effect pressure concentrator. This evaporator is of the external heater, forced circulation type, designed by Peebles Processes, Inc., and is shown diagrammatically with its accompanying equipment in Fig. 3.

This evaporator furnishes liquor of approximately 75 per cent solids concentration to the furnaces and operates continuously and entirely as a closed system in that the heat of high-pressure steam used in the concentrating effects is used successively down through the other effects of the evaporator until its energy is completely dissipated, whereupon the resulting vapor from the various effects is condensed and allowed to flow to the sewer. The non-condensable gases are separated from the condensate and led to the furnaces through suitable flame arresters and explosion seals, where they are burned.

The furnaces, of which there are three, each with a capacity of about 45 tons of equivalent pulp production per day, are of circular construction, 9 ft. inside diameter and 30 ft. high. They are constructed of soapstone ranging in thickness between 18 and 14 in. Four water-cooled tuyères furnish air at pressures up to 2 lb. for the combustion in the lower zone of the furnace. Volume blowers are used to introduce secondary combustion air some 14 ft. from the furnace floor. Three atomizers per furnace are used to introduce the fuel, which is black liquor, no other combustible being used. The action of the 75 per cent solids liquor on being atomized is first to give up its remaining 25 per cent of water as vapor and then to undergo a very rapid destructive distillation. During this distillation, which gives a rapid formation of gas, the particles of liquor are desiccated to a black ash consisting mainly of carbon and inorganic salts. The black ash, on falling to the floor of the furnace, is struck by the blast air from the tuyères, where the temperature is sufficiently raised to allow the reaction between the molten sodium sulphate and the carbon to proceed, producing the sulphide.

The furnaces are connected by a short flue to the waste heat boilers—one boiler for each furnace. The boilers are of the Stirling type, manufactured by the Babcock & Wilcox Company. Each boiler contains 5,670 sq.ft. of heating surface. Seven Diamond soot blowers are installed on each boiler, and it is found necessary in operating the boilers to blow the accumulation of sulphate from the tubes every two hours. It has been found in practice that approximately 12 boiler-horsepower is developed per ton of pulp. In other words, the boilers run between 85 and 95 per cent of rating.

The method found most suitable for handling the concentrated black liquor is to pump it through steam jacketed pipe lines from the concentrator to the black liquor storage tanks. In the storage tanks an atmosphere of steam at about 50 lb. per sq.in. pressure is maintained; this serves to force the liquor through the feed lines and atomizers into the furnaces.

It is of interest to note here the main differences between the older type recovery process, including the disk evaporator and rotary incinerator, and the newer type process described above. In the use of the older type, shown in Fig. 4, the hot gases enter the rotary incinerator at approximately 2,000 deg. F., and leave at about 1,100 deg. F. They then enter the disk at 1,100 deg. F., and leave at 250 deg. F. During their travel

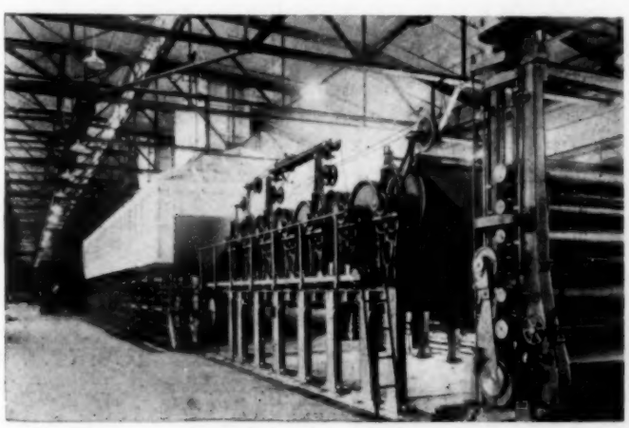


Fig. 5—Black-Clawson Board Machine, 133-in., 100 Ton Capacity

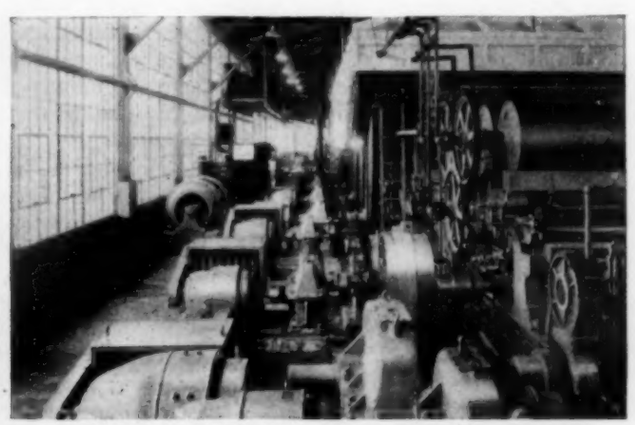


Fig. 6—Electric Drive for the Board Machine

through these two pieces of equipment they are in constant contact with black liquor in various stages of concentration. This condition is, of course, ideal for the destructive distillation of the volatile organic compounds present. This distillation occurs and the gaseous products formed are carried through the system, always with a decreasing temperature gradient. There is consequently no temperature sufficiently high, after the gases have passed perhaps half way through the rotary incinerator, to burn the odor-making compounds, and therefore they are discharged through the stack.

In the newer process described the destructive distillation occurs in the furnace proper at a temperature of approximately 2,000 deg. F. The gases are immediately burned to SO_2 and CO_2 in the furnace itself and are rendered odorless before striking the boiler.

THE BOILER PLANT of the Longview Fibre Company consists of three 860 horsepower Stirling type boilers equipped to burn hog fuel. These are in addition to the three 567-hp. waste-heat boilers previously mentioned. The hog fuel is purchased from the Long-Bell Lumber Company and transported in the same cars which have already been mentioned as being used for chips. The fuel is unloaded into a track hopper which is served by a flight conveyor and elevated to a distribution conveyor in front of the boilers. The boilers are equipped with Beecher step grates in large dutch ovens.

The boiler brick work is the first installation of the Detrick type of suspended, air-cooled side wall and arch construction, as applied to a hog fuel fired boiler. Air is forced through the hollow walls and over the arch by means of a volume blower. This air is then introduced into the furnace through the hollow bridge wall and also over the grates. It has been found possible to carry ratings as high as 220 per cent for extended periods without punishing the brick work. It is an interesting fact that with the step grate furnace the fireman controls his boiler rating entirely by draft regulation. With a load which fluctuates over ten-minute periods between 100 per cent and 200 per cent of rating it is possible with manual draft control to maintain a maximum pressure variation of 5 lb.

The lime recovery system in use at Longview is an example of the modernization tendency throughout pulp and paper mills. Calcium carbonate washed free of caustic from the causticizing operation is dewatered on an Oliver continuous filter and conveyed into the end of a 125-ft. x 6-ft. diameter rotary kiln. Oil for fuel is introduced into the other end of the kiln. The carbonate is burned to the oxide in its travel through the kiln and is discharged into a continuous rotary slaker, where the filtrate from the dewatering operation is used as the slaking liquid. From the slaker the milk of lime flows through a Dorr classifier to remove the unburned core and impurities. The clean milk of lime is then pumped to storage tanks to await causticizing.

The paper-making equipment of the Longview Fibre Company consists of a 133-in. trim Black-Clawson board machine (Figs. 5 and 6) producing close to 100 tons of kraft test liner daily. This product is used as the inside and outside liners in corrugated shipping containers. It is made between 15 and 30 thousandths of an inch thick, depending on the type container desired.

Recently a 172-in. Yankee type paper machine manufactured by the Beloit Iron Works has been installed. This machine produces 30 tons a day of light-weight wrapping and bag paper.

Spalling of Refractories in Oil-Fired Furnaces

IT HAS BEEN the common experience of those using fuel oil for firing boilers that the refractories of the furnaces fail because of spalling, rather than from slagging, whereas slagging is the more common trouble with furnaces fired with powdered coal. The relatively small amount of slagging in oil-fired furnaces is to be expected because the ash content of fuel oil is less than one-tenth of one per cent, whereas that of the coal may be from 8 to 18 per cent; there has been, however, no proven explanation of the very common breaking up of the refractories walls by spalling.

The boiler furnace refractories investigation, which the U. S. Bureau of Mines has been conducting in co-operation with the American Society of Mechanical Engineers, has included a study of furnace conditions of two large boilers using Illinois coal and one using fuel oil. The low fusion temperature of the ash of the coals made slagging a serious cause of trouble in the coal-fired furnaces, whereas the oil-fired furnace showed the usual failures from spalling. A special comparative analysis was made of the measurements taken in the coal- and oil-fired furnaces to elucidate the reason for greater spalling.

The rate of heat liberation in the oil-fired was much higher than in the powdered coal furnaces but the maximum temperatures of the gases observed were the same, 2,800 deg. F. The maximum temperatures measured were somewhat higher in the oil-fired furnace at the positions where the flame impinged on the wall.

The temperature gradient plotted for the first six inches of the hot side of the furnace wall under approximately constant operating conditions was not greater for the oil-fired than the coal-fired furnace.

RATE OF CHANGE in temperature of the furnace walls when the furnaces were banked or fired up were nearly the same. The rate and frequency of change of temperature during steaming were not greater in the oil-fired than in the powdered coal furnace walls; these measurements were taken at $\frac{1}{2}$ inch and further from the hot surface and although they do not predicate the possibility that the small temperature variations at the hot surfaces of the walls were not the same, yet there is not sufficient evidence to warrant the acceptance of change of temperature as the only cause of the greater spalling in the oil-fired furnace and differences in some other factors may be expected.

The chemical composition of the ash of the fuels and of the slags from the walls differed materially in that those from the oil-fired station were higher in sodium and lower in iron and calcium; the softening temperatures were low for all. Microscopic examinations of the slags by the Columbus Station of the Bureau of Standards have shown the presence of a mineral in the oil slag not previously found in coal-ash slag which has been identified as a sodium-calcium silicate.

It is therefore possible that some mineral or minerals formed in the slag or in the combination of slag and brick which was sensitive to thermal shock; or the mineral may have had a much different coefficient of thermal expansion than the brick, and fracture resulted from the difference in the contraction of cooling. The relatively deep fractures found on the side and front walls bear out the former conception, and the thin fractures on the bridge wall, the latter.

Kanawha City, the site of the Owens Bottle plant (foreground) and the Libby Owens Sheet Glass plant (rear)

Charleston Industries Entertain Electrochemical Society

Editorial Staff Report

MORE than 200 members and guests of the American Electrochemical Society met for their fifty-fourth general meeting at Charleston-Huntington, W. Va., September 20 to 22. The program presented was of much interest, including as it did a number of papers of outstanding merit, the ceremonies accompanying the presentation to the society of the $25,000 Edward Goodrich Acheson Fund and a visit to the International Nickel Company's plant at Huntington. In addition there was opportunity for inspection of the many plants whose doors were thrown open for the occasion. Added to the technical aspects were social features which the delegates will long remember with pleasure. The local committee, including such prominent chemists and engineers of the Charleston district as B. H. Jacobsen, J. L. E. Cheetham, A. S. Schoffstall, W. E. Callahan, S. Galperin and W. T. Slicer, together with the Chamber of Commerce, spared no effort in demonstrating the many inducements that Charleston offers for the establishment of electrochemical plants.

At the opening session on high temperatures, held Thursday morning with President P. J. Kruesi of the Southern Ferro Alloys Company in the chair, H. L. Watson and H. Abrams, of the General Electric Company, presented results of their investigation and application of the tungsten-graphite thermocouple. This couple has been used, with suitable protection, to over 1,700 deg. C. in oxidizing atmospheres. Repeated runs to 1,850 deg. C. have been made in the vacuum furnace as well as short runs to about 2,400 deg. C. at atmospheric pressure in reducing atmospheres. The elements, when properly selected and treated, are interchangeable within 5 per cent and an expression has been obtained for the temperature-emf. relation over the useful range. Automatic recording and control of furnace temperatures in ceramics and steel making have been made possible by the use of this couple.

In discussing the paper, James Kelleher of Niagara Falls, and C. G. Fink, of New York, questioned whether, at the high temperatures (1,500 deg. to 2,400 deg. C.) referred to by the authors, the instrument was not more probably a couple between tungsten carbide and graphite. J. T. MacKenzie, of the American Cast Iron Pipe Company, believed that the chief problem still to be solved in high temperature thermocouple work is that of refractories. He said that there is no protective tube which will operate satisfactorily at, say, 2,000 deg. C.

A paper on the high frequency induction furnace for chemical preparations above 1,000 deg. C. covered the painstaking work of its authors, C. N. Schuette and C. G. Maier, of the Bureau of Mines at Berkeley, Calif. They found that such use of the high frequency induc-

Mill of the International Nickel Company at Huntington Where Monel Metal and Nickel are Electric-Smelted, Wrought and Rolled

tion furnace involved many special problems of technique, as for example, special varieties of furnace equipment, a new simple vacuum furnace and special types of crucibles and methods of making them. New methods for the preparation of ferrous oxide, using the induction furnace, were described. In commenting on the paper, W. W. Winship of the Thermal Syndicate inquired about the use of silica crucibles in the Northrup furnace described by the authors. Kelleher and Watson feared that fused silica would become porous and change over to tridymite.

Following this, Secretary Fink presented a contribution received from Kurt Illig of the Siemens and Halske Company, Berlin, on the production and uses of beryllium. In illustration of the paper there was a series of interesting alloys of beryllium and copper, and beryllium and nickel as well as a large sample of beryllium metal just received from Berlin. It was brought out that although Wöhler obtained metallic beryllium a hundred years ago by reduction with potassium, it was not until recently that Stock and Goldschmidt produced the metal by the fused electrolyte method. Their method has been developed by the Beryllium Institute (Germany) and large buttons of metal as great as 150 grams are now turned out commercially.

Discussing the Siemens Laboratory's results, M. Merlub-Sobel, chemical engineer of the Beryllium Corporation of America, said that fluorides are not employed in the American process. Here, the bath operates at 750 deg. to 800 deg. as compared with the German bath at 1,300 deg. to 1,350 deg. He recalled that H. S. Cooper, starting his work in America in 1916, probably made the first sizable ingot of beryllium metal. In further comment, he mentioned the considerably lower bus bar voltage of the American cell, the poisonous character of beryllium fluoride, volatile at high temperatures, and went on to speak of the Beryllium Corporation's plant at Cleveland which is capable of treating two tons of beryl per month, equivalent to about 3 lb. of metal per day. Fink reported briefly on experiments of his in applying the Castner method to the production of beryllium metal.

The next investigation, made by M. de K. Thompson and W. G. Armstrong of the Massachusetts Institute of Technology, covered the vapor pressure of barium oxide. The results are summarized in the accompanying table:

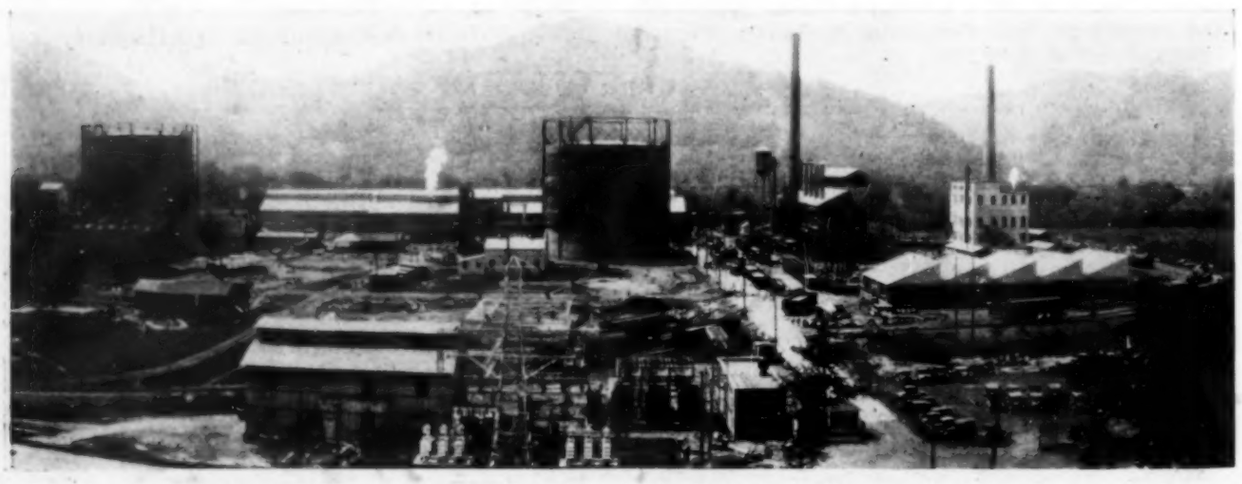
View of South Charleston From the Air Showing the Westvaco, Barium Reduction and Carbide & Carbon Plants

Vapor Pressure of Barium Oxide

Temperature Deg. C.	Vapor Pressure of BaO in mm. Hg
1100	0.03
1200	0.12
1300	0.42
1400	1.6
1500	5.6
1600	20.0
(1880)	(760)

Thompson followed this with a study of the equilibrium of the system: Barium carbide, barium oxide, carbon and carbon monoxide. Equilibrium pressures of the reaction of formation of barium carbide, from the oxide and carbon, were measured at three different temperatures. It was found that the three substances form a single solid solution.

E. F. Linhorst and Herman Schlundt of the University of Missouri submitted their findings on the reduction of barium carbonate by aluminum. The reaction was found to be vigorous and the immediate product complex. A simple method was found to convert this product into nearly pure barium aluminate. Francis Frary of the Aluminum Company of America suggested that it was far simpler to make barium aluminate by reacting barium hydrate with aluminum hydrate.



Plant of Lazote, Inc., Situated 20 Miles Above Charleston in the Kanawha Valley

Friday's session began with the reading of a letter from E. G. Acheson by his son, John Acheson, in which the former outlined the establishment of an Acheson fund of $25,000. This fund, an important milestone in the affairs of the society, provides that a gold medal valued at $250, and a cash prize of $1,000 be awarded every two years to the person who has made a distinguished contribution in electrochemistry, electrometallurgy or electrothermics.

After the presentation, D. M. Greenberg of the California Medical School reported his study of the electrochemistry of the proteins where he found that the transport numbers for casein and the A, B, and C fibrins dissolved in 0.1 N acid or alkali indicated that definite compounds were formed between the acid or base and the protein. The electrode deposit was found to be proportional to the current, and inversely proportional to the amount of acid or base combined with the protein, or to the charge carried by the protein. The transport numbers varied inversely as the mobility of the cation. These results indicated a salt-like behavior rather than the current colloidal theory of protein behavior.

The second paper related to the investigation which R. H. Clark and R. H. Ball, of the University of British Columbia, had made with reference to the electrolytic products of certain halogenyl compounds, bromyl- and iodyl-succinimide and bromyl-acetamide, in various organic solvents. Measurements of the oxidizing power of these compounds supported the belief that the halogens were positive. On electrolysis, using silver electrodes 1.5 cm. apart, the halogens deposited on the anode in all solutions used with the exception of acetonitrile. In this latter solvent the halogen from freshly purified bromyl-succinimide deposited wholly upon the cathode.

At the University of Illinois D. B. Keyes, together with Sherlock Swann, Jr., and H. W. Hoerr, measured the conductivity of several of the more common organic solvents, pure compounds and mixtures. The direct current method of conductivity measurement was used, due to the fact that the Kohlrausch method was unsatisfactory on account of the low conductivity of some of the materials examined. The method described was satisfactory for the determination of conductivities of commercial organic liquids.

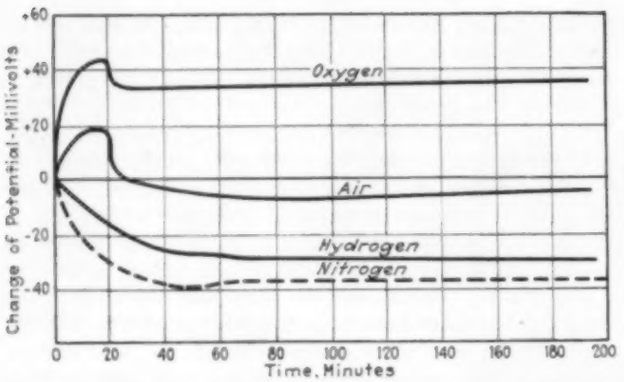
In the discussion that followed, particular stress was laid on the poor conductivity of most organic solvents and on the fire hazard due to static electricity. Moore, Frary, J. R. Withrow of Ohio State University and A. W. Burwell of Niagara Falls all cited cases of various solvents taking fire from a static spark. Moore related that the tracks into the U. S. Industrial Alcohol Company's plant were insulated and the tanks of the tank cars grounded before filling.

A very ingenious method of detecting traces of oxygen in electrolytically prepared hydrogen was presented by W. C. Gardiner and G. A. Hulett of Princeton University. They designed a hydrogen generator which is self-contained, and does not require an external source of current. It is essentially a voltaic cell where no oxygen is generated. The design is such that the electrolyte, previously saturated with hydrogen, completely fills the generator, leaving no dead space so that the first gas delivered is pure oxygen-free hydrogen. A very delicate method of using luminous bacteria, normally occurring in sea water, for detecting minute traces of oxygen in the hydrogen was used in testing the hydrogen generator.

EFFECT of absorbed gas on the contact resistance of carbon was investigated by R. H. Wright and M. J. Marshall of the University of British Columbia. These investigators measured the contact resistance of carbon filaments, both in air and after outgassing at 1,700 deg. C. in high vacuum. For contacts too light to be measured, much lower resistance could be obtained after outgassing. For intermediate contact pressures, outgassing reduced the resistance to about two-thirds of its original value. Heavy contact showed about the same resistance for the two conditions, all of which is in accordance with theory.

One of the outstanding papers of the convention was that of S. J. French and Louis Kahlenberg, of the University of Wisconsin, on the nature of gas-metal electrodes. They found that metals formed gas-metal electrodes with gasses, the potentials of which are specific for the particular gas and metal, and are related to the absorbing power of the metal for the gas and the affinity of the metal for each gas, in case of a mixture. The total combination potential is due both to the absorbed gas and a condensed film of gas on the surface of the metal. Oxygen tends to make the metal potentials less basic, while nitrogen and hydrogen have the opposite effect. Elements having a strong tendency to form acids behave differently with oxygen than do other elements. Elements having amphoteric properties, variable valences, and known to function as catalysts, show greater changes with hydrogen and nitrogen than do the more simple and pronouncedly metallic elements. Carbon monoxide and methane alter the potentials of platinum and palladium

Cabin Creek Refinery of the Pure Oil Company Above Charleston in a Branch of the Kanawha River Valley



Change in Potential of Copper in Various Gases as Determined by Kahlenberg and French

The zero point for the change in potential is taken as the starting potential in air,—271 mm.

materially. On other metals the effect of these gases is slight.

Coating electrodes and stirring the electrolyte has the same effect in preventing the condensation of the gas film on the surface of the electrode. This gas film is a definite phenomenon and because of its instablity causes fluctuations in potential measurements. The so-called single potentials of the metals, determined as they are in air, are in reality the potentials of air-metal electrodes. The most constant electrodes are those which show the smallest difference between their oxygen and nitrogen potentials. The peculiar behavior of aluminum in the electromotive series is due to the formation of an oxygen-aluminum electrode. Amalgamation and alkali electrolytes permit of the formation of hydrogen at the surface of the aluminum electrode and thus give a more basic potential. The delegates were generally in accord with these results and Withrow suggested the use of the data obtained for gas analysis.

It was recently pointed out that H. C. Kremers' collection of rare metals at the University of Illinois contains "the largest ingots of the rarest metals." In the following paper, Kremers and his student, H. C. Thomas, reported on the use of Misch Metal as an electrolytic rectifier. Many of the rare earth metals, including Misch Metal, form satisfactory films for electrodes in electrolytic rectifiers. The presence of iron is detrimental. Electrolytes composed of aqueous solutions of mono-, di- and tri-sodium phosphate, sodium tungstate and a mixture of sodium hydroxide and tri-sodium phophate, were used. The latter solution was found best for practical purposes. E. W. Engle of Chicago, in comment, touched upon the theory and requirements of a good electrolytic rectifier.

A PAPER by G. W. Vinal, of the Bureau of Standards, showed that the voltage of the Weston cell, standard in all the large countries, is 1.018276, accurate within 11 parts per 100,000. Results of recent measurements, which are the beginning of an extended investigation, indicate that the standard in this country has not changed by more than one or two parts in 100,000. Such data as are available on the value of the volt in several countries indicate differences that emphasize the importance of renewed work on this subject.

The concluding paper of the Friday session was prepared by R. H. Lueck and H. T. Blair of the American Can Company, San Francisco, on the corrosion in the tin can. The authors caused some merriment with their cells: Fe-Strawberries-Sn and Fe-Corn-Sn. It developed that in acid solutions free from appreciable concentrations of oxidizing substances, the usual electrochemical relations of iron and tin are reversed, tin assuming an anodic relation to iron. The polarity reversal in the iron-tin cell is due to the large value for the hydrogen overvoltage of the tin as compared with that of the iron. No reversal occurs if the accumulation of hydrogen on the initially cathodic tin surface is prevented.

The society's final session convened under the chairmanship of Duncan MacRae of Guggenheim Bros., and was devoted to papers on the deposition of metals and on electro-analysis. F. C. Mathers of the University of Indiana opened the meeting with an account of his work, performed jointly with his student, H. L. Turner, on the electrodeposition of tellurium. In commenting on the remarkable results obtained, W. Pfanhauser, the noted German plater, wrote: "I have never seen a similar deposit before and wish to express my greatest admiration for the electrochemical feat which this cathode represents. A perfect separation of Te and Se has become possible." Mathers reported that tellurium can be electrodeposited in a firm, smooth condition upon lead cathodes from solutions of tellurium dioxide in mixtures of hydrofluoric and sulphuric acid. Solutions of tellurium dioxide in nitric or in hydrochloric acid give much less satisfactory deposits. All tellurium deposits are brittle; consequently they offer little encouragement for use in commercial electroplating. The deposit of tellurium is free from selenium thus giving a method of refining metallic tellurium. The selenium remains as a slime on the anode.

IT WAS next reported how R. L. Dorrance and W. C. Gardiner of Queen's University, used a Haring cell in the determination of the polarization and resistivity of nickel plating solutions. The anodic polarization was considerably reduced by the presence of chloride ion, although no appreciable difference was noted in the action of metallic ion, potassium, sodium, ammonium, nickel, or magnesium associated with the chloride ion. The effect of bromide ion was the same as that of chloride ion, while the fluoride ion did not materially reduce anodic polarization. G. B. Hogaboom of the Hanson & Van Winkle Company, took issue with the authors on account of their broad pH limits, 5.4 to 5.8, maintaining that much closer limits are to be followed in good nickel plating practice. Furthermore, he believed that the use of color indicators cannot compare in reliability with electrometric methods of determining pH.

A new method for making oil-less bearings and dynamo brushes was outlined in a paper on the codeposition of copper and graphite by C. G. Fink and J. D. Prince of Columbia University. Upon addition of Aquadag to acid copper sulphate solutions, electrolysis deposited graphite with the copper on the cathode. Gelatine was used for stabilization, a little over one gram per liter being sufficient. Upon analysis, as much as 16 per cent graphite (42 per cent by volume) was found on the cathode deposit, the balance being copper.

Duriron was found to be very serviceable as an insoluble anode for gold cyanide solutions in an investigation reported next by M. de K. Thompson. The alloy withstood corrosion well in the cyanide solution and made a better anode than lead in the electrolytic extraction of gold. Fink, in discussing the paper, referred to his own researches on insoluble anodes, in particular the silicide anode. The copper silicide anode is used on a large scale at the Chuquicamata plant in Chile. He said

that the most insoluble anode of the silicide group is the cobalt silicide anode. Hogaboom found that gold was precipitated out of solution with Duriron anodes and that Nichrome anodes were preferable. Engle mentioned that the addition of a small amount of cobalt to the sulphate solution rendered the lead anodes more insoluble.

The use of steel anodes for chromium plating formed the subject of a paper by E. M. Baker and E. E. Pettibone of the University of Michigan. The effects of variations in the per cent of carbon in the steel on the rate of anode corrosion, and on the oxidation of trivalent to haxavalent chromium, were studied. The steel having the lowest carbon was most resistant to corrosion; and electrolytic iron was more resistant than steel. The equilibrium concentration of trivalent chromium was about the same for all of these anodes.

A study on the porosity of electro deposited chromium by E. M. Baker and A. M. Rente of the University of Michigan brought out the fact that, from a negligible thickness of deposit to 4×10^{-3} mm., a point of minimum porosity was found to exist for all bath compositions and temperatures investigated. The thickness necessary to give minimum porosity increases with the increasing bath temperature, but the least porous deposit can be obtained at higher temperatures, about 55 deg. C.

The making of nickel mirrors by the nickel-carbonyl method formed the subject of an investigation reported on by C. G. Fink and W. G. King, Jr., of Columbia University. Nickel-carbonyl was decomposed in contact with heated glass surfaces, producing perfect mirror deposits. The method proved to be applicable in the manufacture of such products as Dewar flasks. The authors found that best results were obtained with a complete absence of foreign gases and with glass temperatures at 180 to 200 deg. C. Other materials besides glass were also coated with nickel in this manner. It was found that the heat reflectivity of the nickel mirror was almost equal to that of a silver mirror. The deposits had a high electrical conductivity, adhered tenaciously and were found to be tough and resistant. It was suggested that the deposit might serve as a foundation for the electrodeposition thereon of chromium, copper and other metals.

THIS ACCOUNT led W. T. Griffith, of the Mond Nickel Company, to a description of the carbonyl process as carried out at Swansea, Wales. He mentioned that the production was very large and resulted in nickel practically free from cobalt. The temperature used was slightly higher than that recommended by the authors of the present paper for mirrors.

Spain was also represented at the convention. A. Rius of the Industrial School at Saragossa submitted two papers. The first dealt with the electrometric determination of hydrogen peroxide and the associated peracids. Using sodium sulphite solution as a standard, he developed a new electrometric titration method for the determination of H_2SO_5 and H_2O_2 in solutions containing also $H_2S_2O_8$. H_2O_2 is determined in the presence of H_2SO_5 by the author's modification of Birkenbach's potassium permangate method. An analogous method may be employed for mono-persulphuric acid. In mixtures of the three, persulphuric acid is determined by difference.

THE SECOND PAPER by this author, written with V. Arnal, discussed electrometric titration of hypochlorite and hypochlorite-carbonate mixtures. An electrometric method was developed using 0.1 N sodium hydroxide solution. Results indicate that neutralization occurs in a one-stage reaction. Since the potential of a chlorine electrode varies with the pH of the solution, hypochlorite, alkali carbonate and free hydroxide can be determined by a single titration.

The final paper by J. O. Closs and Louis Kahlenberg, of the University of Wisconsin, reported the use of simple metallic electrodes in the potentiometric titration of acids and bases. The single potentials of various metals in dilute alkali and acid solutions and the potentials of acid-alkali chains using two electrodes of the same metal, together with the effect of various factors upon the potentials of metals in acids and alkalis were studied. The observation was made that tungsten, molybdenum, arsenic, antimony, bismuth, aluminum and tin showed great differences of potential in 0.1 N acid and caustic soda. This observation showed that these metals could be used as indicator electrodes in titration. Various acids were titrated with sodium hydroxide using each of the above metals as an indicator electrode. The method gave satisfactory end-points in all cases. With the exception of tin, all of the metals studied behaved similarly.

It was announced that the spring meeting of the society will be held in Toronto, May 27 to 29, 1929. W. L. Miller of the University of Toronto, will have charge of the arrangements as chairman of the local section. The main session will be devoted to the electromagnetic characteristics of electrochemical processes.

At Belle, Above Charleston on the Kanawha River are the Plants of Belle Alkali Company (Right) and Sharples Solvents Corporation (Left)

World Fuel Problems Discussed in London Conference

Special Correspondence

THE second of the great international meetings under the auspices of the World Power Conference was held at the Imperial Institute in London, from September 24 to October 6. Delegations from 47 nations contributed to a total attendance of 1,500. Of the 170 papers presented before the various sections, about two-thirds dealt with some phase of the coal problem. Although somewhat less attention was directed to liquid fuels and to their utilization, these fields were competently discussed by world authorities. The meeting was significant not only because of its pooling of international views, but also because it brought together on a common ground such apparently diverse interests as power generation and gas manufacture, petroleum refining and chemical industry.

In his opening address, Sir Robert Horne declared that the modern prosperity of Great Britain was created by coal, and by coal it would be saved. He looked with hope, therefore, on the development of carbonization processes although thoroughly appreciative of the present embryonic status of the low-temperature development. Notwithstanding the fact that low-temperature carbonization of brown coal has been practiced for 80 years in Germany, and something like 400 different processes had been developed in various countries, the economic success of the method, except under highly localized conditions, is yet to be proved. Doctors Lander and Sinatt, in a paper on this subject, stated that in Great Britain there are now 16 experimental plants which are capable of handling 10 tons of coal or more per day. The majority of these plants give a combined yield of 18 to 22 gal. of tar and spirit (motor fuel) per ton. In the case of a plant treating cannel yields of 50.2 gal. of tar and 3.7 gal. of spirit are reported. These authors state, however, that "investigations of low temperature tar do not appear at this stage to have revealed any special feature likely to raise the commercial value above that of high temperature tar."

Discussion of petroleum had to do largely with major economic considerations involved in world production and with the part the cracking process has played in the problem of utilizing available supplies. In the former connection, the chairman of the section, Sir Robert Waley Cohen, and the vice chairman, J. Kewley, emphasized the fact that we have only begun to tap our petroleum resources. The total world production of crude oil since 1859 amounts to only 0.8 cu. mile of oil.

In addition to cracking it is expected that the industry will develop by increasing the number and importance of products derived from petroleum. The great expansion of the asphalt industry in recent years is an example. The vast quantities of natural gas now wasted might be conserved for the manufacture of such products as formaldehyde and methanol. The gases from the cracking processes could furnish greater quantities of alcohols, glycols, and like products which may be made from the reactive unsaturated hydrocarbons. As an example of the opening up of new fields, it was cited that in the United States the number of household oil burners has increased in 5 years from 100,000 to 1,100,000. The consumption of gas oil for heating purposes is now over 70,000,000 bbl. in this country.

Dr. Gustav Egloff, an official American delegate, delivered an address entitled "The Cracking Process—a Universal Source of Motor Fuel," and he also contributed an American viewpoint to the discussion of refining technology. He pointed out that in addition to petroleum, coal, shale, wood tar, vegetable oils, peat tar, and fish oils could be made by heat and pressure to yield 50 per cent or more of gasoline. He estimated that by 1938, there would be 75 million automobiles in operation, and the demand for gasoline would rise from the present figure of 16 billion gallons to 40 billion gallons per year. Yet we need have no fear of shortage, he maintains, if our oil supplies are properly utilized.

Dr. Egloff suggested that France, England, Germany, and Italy, since they have no crude oil reserves, should install cracking units and should purchase and store large quantities of fuel oil to be used as cracking stock when peace-time requirement or national crisis demanded. For storage, he advocated construction of concrete tanks to hold collectively from 100 to 300 million barrels. Moreover, in times of national necessity the hydrocarbonaceous material could be cracked into benzol and toluol, which were two primary materials necessary for the conduct of war, and these could be converted by nitric acid treatment into picric acid and T.N.T.

The value of the cracking installations in the world at present was estimated to be $275,000,000, and the present efficiency of cracking installations is four times as great as that of a dozen years ago. In his view there had not been a greater technical and scientific achievement in the world than the development of the cracking process. It can be so controlled that any quality of anti-knock material can be produced at will.

In the United States 148 of the 312 operating refineries are equipped with cracking units. The remaining 164 without cracking equipment have but 23 per cent of that country's capacity for handling crude oil. The total cracking capacity is 1,328,000 bbl. of charging stock per day. In 1927 the United States refineries produced 101,000,000 bbl., or 4,200,000,000 gal. of cracked gasoline, which was 30.6 per cent of the total motor fuel as shown in the table following:

Production of Gasoline by Various Methods in United States

(Thousands of Barrels)

	1927		1926		1925	
	Total	Per Cent	Total	Per Cent	Total	Per Cent
Total gasoline production	330,667	100.0	299,734	100.0	259,601	100.0
Straight run gasoline	197,282	59.7	178,302	59.5	171,382	66.0
Cracked gasoline	101,224	30.6	93,736	31.3	68,583	26.4
Natural gasoline	32,161	9.7	27,696	9.2	19,636	7.6

An interesting indication of the future trend in petroleum utilization was to be seen in a number of papers on high-speed Diesel-type engines for automotive use. H. R. Ricardo pointed out, however, that saving in fuel thus effected would have to be balanced at present against the greater difficulty in starting, greater weight per horsepower, and the handling of a dirtier and otherwise more objectionable fuel.

Official American delegates at the conference included the following: Dr. Gustav Egloff, petroleum technologist, Universal Oil Products Co., Chicago, Ill.; H. W. Brooks, consulting engineer, New York City; O. P. Hood, chief, technological branch, U. S. Bureau of Mines; Martin Frisch, manager of field engineering, Combustion Engineering Corporation, New York City; G. A. Orrok, consulting engineer, New York City; David B. Rushmore, former consulting engineer, General Electric Co.; and O. C. Merrill, executive secretary of the Federal Power Commission.

Advances in Reclaiming Tin from Silk Weighting Washings

By Gibson Buttfield

Industrial Associates, Inc., New York

ONE OF THE STEPS in the weighting of silk consists of immersing the de-gummed fibers in a solution of stannic chloride. After the required time, the silk is removed and placed in washing machines where it is treated with large volumes of water to precipitate the tin absorbed by the fibers as an insoluble hydroxide or hydrated oxide and to remove the excess stannic chloride.

While the percentage of tin contained in wash waters is very small, it represents approximately one-third of all the tin used by the weighters, and when salvaged, its value is considerable. The efficient and complete recovery of this tin is therefore of great importance.

One of the difficulties attending efficient recovery of the tin lies in the enormous quantities of water that must be treated—from 1 to 4 million gallons daily in the larger plants. Another difficulty occurs in drying the concentrated hydrous tin oxide owing to its peculiar nature and its high moisture content.

AT PRESENT the general practice among silk weighters is to precipitate partially the tin oxide from the wash waters by dilution with consequent hydrolysis, assisted by the neutralizing effect of running the solution over a bed of limestone. Such incomplete neutralization not only prevents complete recovery of the tin but permits serious corrosion of pipe lines, pits and pumps. Corrosion not only destroys the equipment, but contaminates the dried oxide with iron and silica, greatly detracting from its sales value.

The settling of the precipitated tin takes place in rectangular concrete pits, with provision for continuous hydrolysis but no means whereby the settled sludge may be withdrawn continuously. It is, therefore, necessary to provide duplicate tanks to permit cleaning. The supernant water is intermittently discharged to the sewer and the sludge pumped to a storage tank. Considerable quantities of tin in suspension are thus lost. The effluent contains from 16 to 75 mg. of tin per liter of wash water in addition to the tin lost in pumping.

The sludge is fed by gravity from the storage tank to a filter press which reduces its water content to 75 to 85 per cent. The drying of the filter cake is accomplished in a kiln, tray or rotary drier. These methods are slow and inefficient due to the fact that hydrous tin oxide, on drying, becomes coated with a thick, impervious skin of semi-dried material which greatly retards evaporation.

To assist some of the silk weighters, an investigation was undertaken by the writer, then with The Vulcan Detinning Company. After considerable experiment, a new process was evolved and adopted by the Textile Dyeing Company of America, Inc., at Hawthorne, N. J. This company's recovery plant has recently been put into operation with complete success.

In the operation of the new process, the tin-bearing solution, on leaving the wash machines, is neutralized by the automatic and continuous addition of a lime slurry, thus securing practically complete precipitation of the tin. Settling of the tin flocs is accomplished in a Dorr thickener which gives substantially complete settling.

Chute Beneath the Drier Tower Where the Recovered Product is Bagged

The sludge is continuously pumped to an overhead storage tank, flowing thence by gravity to a spray drier where it is instantaneously dried and automatically delivered to barrels or bags, for shipment. Continuous operation, from the time the solution leaves the wash machines, to the shipment of the oxide is the result.

The lime slurry is prepared in an agitated tank and is continuously added to the wash water through an automatically adjusted outlet. This addition occurs as near the wash machines as possible to obtain thorough mixing and hydrolysis before the suspension enters the thickener. The precipitated hydrous tin oxide is run over and under a series of baffles just before entering the thickener. These serve to remove air bubbles entrained in the water, and which otherwise might attach themselves to the flocs and cause them to float. This condition would cause much tin to be lost.

USE of a spray drier—never before employed for this purpose—was decided upon after the elimination of other methods. Its adaptation is a very great improvement and, to its efficiency and simplicity, the process owes much of its success. The drier, designed and developed by the Industrial Associates, Inc., of 101 Park Avenue, New York, using a high-speed centrifugal atomizer, creates a zone of atomized sludge. Hot air passes through the zone, carries away the moisture and exits through suitable ports. The sludge, dried to any desired water content, falls to the bottom of the drier tower and is discharged directly into shipping containers.

The moist hot air passes through a second atomized sludge zone in a scrubber tower. This accomplishes a pre-concentration of the sludge, as drawn from the storage tank, recovers any fine particles of dried oxide that may have been carried over, and permits nearly complete utilization of the heat. Recovery of the product and efficiency hence quite nearly approach the theoretical. Tin loss has been reduced to approximately 4 mg. per liter of wash water. Drying cost is reduced 50 per cent and total operating costs are about one-third of the original. Elimination of impurities from the dried oxide considerably increases its value.

TAPPI Discusses Technical Control, Waste Prevention and Efficient Use of Forest Products

By R. G. Macdonald

Secretary-Treasurer, Technical Association of the Pulp and Paper Industry, New York

SYMPOSIA dealing with technical control in pulp and paperboard mills, waste prevention and the efficient conversion of forest products into papermaking materials featured the technical program of the fall meeting of the Technical Association of the Pulp and Paper Industry at Wausau, Wis., on September 25 to 27, 1928. Nearly 350 managers, superintendents, engineers and chemists gathered together in this annual conclave of the pulp and paper making fraternity. Inspired by a good program of worthwhile papers, excellent cool weather and the good fellowship that is so characteristic of the TAPPI meetings much was accomplished toward the upbuilding of the industry.

The technical control symposium covered all phases of chemical pulp manufacture and initiated a new sphere of interest in considering the field of paperboard manufacture. E. F. Whittington, chief chemist of the Sutherland Paper Company, Kalamazoo, Michigan, read a paper on this subject in which considerable attention was directed to the methods that should replace those now used in estimating the degree of sizing of board and the finish of liners. The savings that will result from a study of the average white water loss of board mills will repay nearly all board mills many times the cost of the making of the investigations by competent technical men.

AT PRESENT there is considerable difference of opinion concerning the manner in which the pulp is prepared for sheet making. The laboratory beater is preferred by some while others prefer the simple propeller type of agitator and another group advocates the use of the porcelain pebble mill. W. F. Moore of the United States Testing Company reported the use of a bronze rod mill for preparing the stock and obtained results that were unusual in their uniformity.

Under the chairmanship of H. L. Joachim of the Container Corporation of America, the symposium on waste, including also the discussion of corrosion, concerned itself primarily with a group of reports on the prevention of stock losses from the mill. Paper mills must of necessity use large quantities of water for transporting pulp at consistencies of usually less than three per cent. In the past most of the water used was fresh water from the adjacent rivers. Upon being used once it was discharged into the river and usually carried with it paper stock. The apparent loss in weight of materials in the process is known as shrinkage. As a result of the studies that are being made by the members of the Committee on Waste Problems and reported at this session, the recognized permissable amount of waste in mills is annually decreasing.

The current projects being worked on at the Forest Products Laboratory at Madison, Wis., were explained by members of the technical staff under the direction of C. P. Winslow and C. C. Heritage. Of outstanding interest was a paper by G. C. Ritter and G. H. Chidester of the Laboratory, who outlined the results of their studies of the microstructure of a woodpulp fiber. Ritter has been able to dissect a single fiber by chemical means and to investigate its fibril construction.

In his paper discussing the chemistry of the alkaline wood pulp processes, M. W. Bray reported that the velocity of the pulping reaction is affected by the temperature at which spruce wood is digested with sodium hydroxide. It was found that increasing the temperature materially increased the rate of reaction, and with a rise of 10 deg. C., approximately the same yield, the same chemical properties of the fibrous residues and the same chemical consumption are obtained in half the time.

IN STUDYING the pulp bleaching process at a constant temperature of 35 deg. C., and at a constant agitation rate, P. K. Baird found that the bleach consumption is a function of the logarithm of the time up to 90 per cent of the bleach chemical consumption and that the best guides to proper bleaching of a pulp are the alpha cellulose value, the alkali solubility and the copper number.

A group of miscellaneous papers were presented to show technical developments along engineering lines. E. F. Hulbert, chief engineer of the Cornstalk Products Company, Danville, Ill., outlined the history of this company and described the present process of pulp manufacture. R. Skagerberg of St. Paul, Minn., described the new paper machine ventilation system installed at the Cornell Wood Products Company plant at Cornell, Wis. This consists essentially in enclosing the driers in a hood which extends to the machine room floor. S. R. Olsen of the Northwest Paper Company, reported his research findings concerning the rosin sizing of paper. He pointed out the fact that under commercial conditions the optimum hydrogen ion concentration for the best rosin sizing is in the range between pH 4.5 and pH 6.5. The maximum adsorption of rosin is from pH 4.0 to pH 4.5 for purified pulp. The variables affecting size adsorption include: kind and quality of pulp used, its degree of washing, the kind and amount of filler used, the amount and hardness of the water used and the quality of the paper being manufactured.

OF CONSIDERABLE significance was the first presentation by the Technical Association of a gold medal to two men who have made outstanding contributions to the technical development of the pulp and paper industry. These are W. H. Mason of Laurel, Miss., and Ogden Minton of Greenwich, Connecticut. The former is the inventor of Masonite, a wallboard prepared from wood fibers produced by exploding wood. Wood waste obtained from lumber mills is subjected to high steam pressures (1,000 pounds per square inch) which upon exhausting through restricted slots delivers the wood in fibrous condition (See *Chem. & Met.*, June, 1927, page 343). Ogden Minton is the inventor of a system of drying paper under a vacuum.

The success of the meeting was largely due to the activities of the excellent local committee headed by Allen Abrams of the Marathon Paper Mills Company, Rothschild, Wis. That the paper mills of the Wisconsin River Valley were generous hosts to the visiting delegates also contributed largely to the meeting's success. During the two days following the regular meeting an open house was held by the U. S. Forest Products Laboratory at Madison, to demonstrate to the visitors the manner in which projects were worked upon to obtain the results reported in the papers presented at Wausau Meeting.

Graphical Distillation Study Avoids Calculation

A SIMPLE graphical method for determining the efficiency of a fractionating column was described by H. Branden, writing in *Die Chemische Fabrik*, May 9, 1928. In order to determine the efficiency of such a fractionating column from a knowledge of the composition of the distillate, it is first necessary to know what the composition of the distillate would be without the column in use. It is well known that a vapor mixture in equilibrium with the liquid mixture contains a larger proportion of the more volatile component than does the liquid. If this vapor be condensed directly, there is obtained what may be known as the "natural" distillate which is quite independent of the style of plant used, and may be considered as a reference point from which the influence of the plant equipment may be determined. The familiar type of diagrams ordinarily used with distillation problems which give the composition of the vapor above the liquid mixture of a given concentration necessitate considerable calculation in their use, as the composition of the residue changes continuously during distillation, and this change must be taken into account. This may, however, be avoided by the application of the following comparatively simple graphical method.

Let A be the quantity of the starting material, and a the percentage content of the more volatile constituent. R and r may be considered corresponding values for the residue at a given instant, and U and u are those for the distillate. Then, at any instant we have

$$U + R = A \qquad (1)$$

and

$$Uu + Rr = Aa \qquad (2)$$

If a solution of concentration r be in equilibrium with a vapor of concentration $f(r)$ and the infinitesimal quantity dR, of composition $f(r)$ evaporate, the residue is diminished by the infinitesimal amount dR, and the distilled quantity dR, of composition $f(r)$ must, when added to the residue $(R - dR)$, of composition $(r - dr)$, give again the residue R, content r. That is,

$$dRf(r) + (R - dR)(r - dr) = Rr$$

from which

$$\frac{dR}{R} = \frac{dr}{f(r) - r}$$

In integrating, it must be remembered that when $R = A$, $r = a$, so that

$$\log_e \frac{R}{A} = \int_a^r \frac{1}{f(r) - r}\, dr \qquad (3)$$

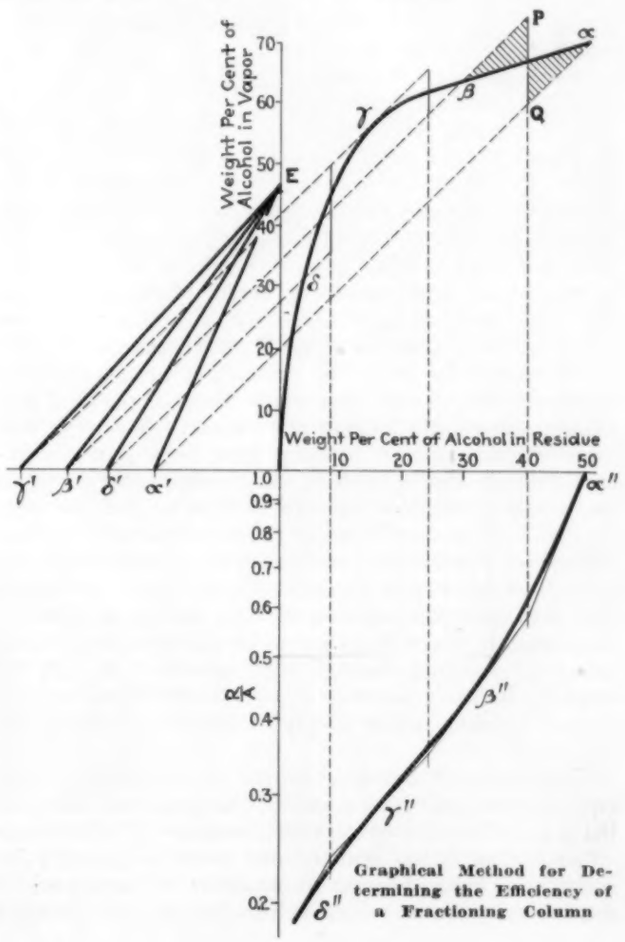
Now, this equation could be solved, but a graphical method such as is shown in the accompanying curve, makes it much simpler. As an example, it is assumed that a 50 per cent alcohol-water mixture is to be distilled. The upper right portion of the curve gives the alcohol content of the vapor above solutions of from zero to 50 per cent alcohol. The abscissas then represent r and the ordinates $f(r)$. A series of points, α, β, γ, δ are taken on the curve and lines are drawn at an angle of 45 deg. through these points, meeting the axis of abscissas at the left of the origin at the points α', β', γ', δ'.

The axis of ordinates is continued downward from the origin and is subdivided into a logarithmic scale as shown. Points corresponding to the ratio of R/A may be taken on this scale, which scale is continued above the origin to the point E at a value corresponding to the value of the natural log base, $e = 2.718\cdots$. This point E may then be joined to the points α', $\beta'\cdots$ previously obtained, and a line drawn from α'' parallel to $E\alpha'$, meeting the extension of the ordinate PQ. The position of the latter is obtained by making the two shaded areas as nearly equal as possible to the eye. Similar parallels, $E\beta'$ and so on are drawn as shown, and the resulting broken line so obtained is smoothed into a curve touching the straight portions at α'', β'', γ'' and δ''. This gives a curve showing the instantaneous relation between the quantity and concentration of the residue, assuming "natural" distillation. The concentration of the distillate may now be readily calculated from equations (1) and (2) which give

$$u = \frac{a - rR/A}{1 - R/A}$$

If it is desired to start with a concentration lower than that for which the curve was developed, the logarithmic scale must be displaced until the point $R/A = 1$ on the curve gives the proper starting concentration. The R/A scale, if drawn upon a strip of paper so that it may be moved along the ordinate axis permits easy accomplishment of this result.

To be certain that the diagrammatic result is correct, note that the distances from the origin to the points α', β', γ' and δ' represent the values, at any given instant, of $f(r) - r$. Similarly, the distance from the origin to E represents the unit of the natural logarithmic scale. The slopes of the lines $\alpha'E$, $\beta'E$, etc., are then $1/(f(r) - r)$, and correspond to that of the corresponding points α'', β'', etc., of the curve.



Graphical Method for Determining the Efficiency of a Fractioning Column

Development of the Cracking Process in the Petroleum Industry

By Ernest Owen
Brooklyn, N. Y.

WITHOUT doubt the most outstanding development in the petroleum industry in recent years has been in improvements in the technique and equipment for cracking heavy hydrocarbon oils to gasoline. These improvements, resulting in a greatly increased production of gasoline, are in a large part responsible for the tremendous growth of the automotive industry, which is playing such an important part in the social and economic life of the country today.

There have been startling improvements in the cracking process in recent years. At the moment the vapor-phase method holds the center of the stage in technical development yet important improvements are being made in other directions. To appraise the importance of all of these developments from a chemical engineering viewpoint, Ernest Owen, formerly superintendent of design for the Tidewater Oil Co., has prepared three interesting articles. The first deals particularly with vapor-phase developments.

Economic Aspects of Cracking—During the period from 1916 to 1927, which represents the most rapid growth in the number of cars and trucks in use, the production of crude oil increased 200 per cent, the production of gasoline increased 575 per cent, and the number of cars and trucks registered increased 569 per cent. In other words, there was three times as much crude oil produced in 1927 as in 1916, 6.8 times as much gasoline produced, and 6.7 times as many cars and trucks registered. Despite the fact that the number of barrels of crude oil per car registered decreased from approximately 85 barrels per car in 1916, to 39 barrels in 1927, the production of gasoline has been sufficient to take care of the domestic demand, and allow a reasonable amount for export. It is true that other factors besides cracking have been partially responsible for the increase in the gasoline yield based on the crude, from 19.8 per cent in 1916 to 39.9 per cent in 1927. These are notably (*a*) improvements in distilling and fractionating equipment in oil refineries; (*b*) growth of the natural gasoline industry; and (*c*) reduction in evaporation losses on the lease and at the refinery. Nevertheless, these items are of minor importance compared to cracking. Government reports show that the cracking industry contributed over four billions of gallons of gasoline to our supply of motor fuel during the past year.

The discovery and development of the cracking principle has not only revolutionized the petroleum situation but it has effected a conservation measure of incalculable value in that it has doubled our potential gasoline resources. The conversion of products of petroleum of the lowest economic value, such as fuel oil, into products of the highest economic value, also has been accomplished at a comparatively low cost of manufacture. What was formerly a byproduct—fuel oil—can be now converted into gasoline. As Dr. Egloff states: The effect is the same as if we had discovered a vast oil field producing over five hundred million barrels of crude oil a year.

This basic modification in the practice of gasoline manufacture is deeply affecting the entire trend of refining practice, is altering the past channels of fuel oil consumption to a marked degree and is materially changing the price structure for crude oil and its products.

While the cracking of heavy oils has contributed very materially toward the conservation of the petroleum resources of the nation, it is for no such altruistic reason that the refining companies have invested hundreds of millions of dollars in cracking units in recent years, but rather from the stress of economic necessity. The problem of the refiner is the breaking up of the raw material, crude oil, into various products that he can sell at a profit. A study of the developments during the past two or three years clearly indicates that refiners have come to realize that they cannot survive in the manufacturing end of the oil business unless they install equipment which makes possible the maximum recovery of gasoline, the most desirable product obtained from crude oil.

The refiner who has a cracking plant has a flexibility of plant operation which has made it possible to take advantage of any opportunity to secure the maximum returns from his operation. It is interesting to note from an economic standpoint that a recent refinery survey (*Oil and Gas Journal*, Mar. 1, 1928) showed that, out of 144 oil refineries now shut down, only 21 are listed as having any cracking equipment whatever. In many cases those possessing cracking equipment had antiquated units of early design. In contrast to this, over 50 per cent of the now operating plants have cracking units.

Cracking has been spoken of as "the great balance wheel of the industry, stabilizing production, permitting flexibility in the refinery, allowing adjustment of supply

and demand and, withal, making available to the motoring public gasoline of superior quality."

Historical Development of Cracking—In tracing the development of petroleum cracking we find that the first mention of this phenomenon was in a patent (U.S. Pat. 28,246) granted to L. Atwood in 1860 in which he describes a method of increasing the yield of illuminating oils by cracking distillation at atmospheric pressure. Since cracking is a direct function of temperature and time of reaction, the next logical step was the application of pressure to increase the temperature at which distillation takes place. When no pressure is employed the greater proportion of the hydrocarbons in the oil will vaporize and pass out of the reacting sphere with only slight decomposition. A patent of this nature was granted to J. Young (Brit. Pat. 3345) in 1863 covering the treatment of shale oils and mentioning a pressure of 20 lb.

The use of relatively high pressures was first covered in a patent taken out by Benton (U.S. Pat. 342,564) in 1886. This specified heating the oil to a temperature of from 700 deg. F. to 1,000 deg. F. in a pipe coil, and then discharging it into a low-pressure vaporizing chamber. Mention was made of operating pressures up to 500 lb. per sq.in.

It will be noted that these patents of both Young and Benton released the pressure prior to condensing the evolved vapors. In 1890, J. Dewar and B. Redwood were granted patents (U.S. Pats. 419,931 and 426,173) which had considerable bearing on future patent litigation and which covered both the vaporization and condensation under high pressure. Pressure, however, was maintained in the condenser by means of an inert gas.

ALL these investigators might be said to be unfortunate in that they made their inventions before there was any large demand for the products they could produce; for it will be recalled that the industry had been chiefly interested in kerosene. About twenty years ago, however, the automotive industry started to become an economic factor and the need for increased production of gasoline became apparent. It was, nevertheless, not until 1913 that cracking became a commercial possibility, when Dr. Burton and his associates at the Standard Oil Company of Indiana developed the so-called "Burton process." From a process standpoint, there seems to be little essential difference between the Burton patent and that of Dewar-Redwood.

The details of the Burton process were worked out in such a manner that it fitted into existing refinery procedure and organization so perfectly, requiring a minimum of special knowledge either in the construction or operation of equipment, and necessitating the minimum changes in accepted refinery practice—aside from the pressure distillation—that within a couple of years several hundred units were in operation.

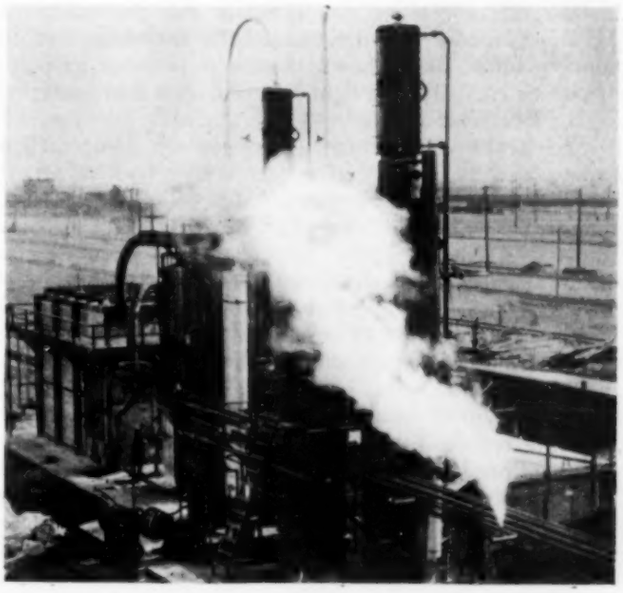
It was inevitable that the success of the Burton process, involving a large industry of such importance, should create a great deal of interest in cracking. The patents of Dr. Burton were rapidly followed by an avalanche of additional patents by other investigators, covering every conceivable phase of the cracking art. Few of these patents are basic in any respect, while many are only slight structural modifications of previous patents. This has naturally resulted in a complicated patent situation for which there seems to be no solution except drastic action on the part of the judicial and legislative branches of our government.

Methods of Cracking—The methods of cracking may be classified as follows:

1—Electrical processes
2—Chemical processes
3—Thermal processes
  (*a*) Strictly vapor-phase
  (*b*) Semi-liquid-phase or distillation processes
  (*c*) Liquid-phase digestion processes without distillation in the cracking zone

While it is realized that this system of classification is open to criticism on several grounds, especially since some processes will fall under two of the divisions mentioned, nevertheless it is believed to be as satisfactory as any yet devised.

Electrical Methods of Cracking—Much interest has been manifest during recent years in the application of electrical energy to the problem of decomposing heavy oils. Particular interest has centered in the use of the corona or silent discharge of very high tension and frequency. Those methods that consist in passing oil, either in the liquid or vapor state, over incandescent filaments or bodies heated by the resistance offered by the body to the passage of electric current, are strictly not relevant to the subject under consideration, since in these cases it is heat and not electrical energy that is being utilized as such. It might however be mentioned in this connection that not only is heating by electricity expensive, but numerous operating difficulties are encountered.



A Vapor-Phase Catalytic Cracking Plant in Baltimore
This installation at the Interocean Oil Company has a capacity of 250 bbls. per day and is the largest of the Stellarene (Leamon process) units.

Claims have been made by various inventors that high frequency discharges would cause a breaking up and rearrangement of the "electronic solar system" of the molecules. Most of these patents provide for passing heavy hydrocarbon vapors, either alone or mixed with a hydrogen-containing gas, through externally heated tubes. The walls of the tube act as the receiving electrode, while a filament suspended in the center of the tube functions as the discharge electrode. Research work by various petroleum technologists, however, seems to indicate that it is not possible to affect any appreciable decomposition of hydrocarbons by the action of the silent discharge. On the other hand, investigations of the

Original Installation of the Gyro Vapor-Phase Cracking Process
This unit in the Cabin Creek, West Virginia, refinery of the Pure Oil Company has a capacity of 750 bbls. per day. The standard units now being installed have a daily capacity of 1,000 bbls. of fresh charging stock.

chemical behavior of hydrocarbons of low molecular weight under the ionizing influence of silent electrical discharges, now being conducted at the University of Minnesota under the direction of the American Petroleum Institute, have shown that it is possible to polymerize or condense the light hydrocarbons into others of higher molecular weight.

The action of corona discharges on hydrocarbon vapors was the subject of a very comprehensive set of investigations by the Bureau of Mines ("Effects of the Corona Discharge on Petroleum" by J. J. Jakosky, Tech. Paper 375, dated 1926). The results of these experiments may be summarized as follows:

1. Electrical activation of hydrogen and natural gas for the hydrogenation of unsaturated cracked gasoline by the use of the corona discharge is of such small magnitude as to be negligible in the refining of petroleum and the production of gasoline.
2. The corona discharge in itself produced no cracking of the oil present in the vapor phase.
3. The slightly increased cracking obtained by the use of the corona was due to the mechanical precipitation of the heavier oil particles and mist against the hot walls of the cracking tubes.

Chemical Methods of Cracking—Chemical methods of cracking have, so far, failed to obtain any economic importance in the cracking industry, although a great deal of experimental work has been done along these lines. As far as the writer knows, the aluminum chloride process, as developed by A. M. McAfee of the Gulf Refining Company and G. W. Gray of the Texas Company, and the vapor phase processes of Ramage (gyro) and Leamon, are the only catalytic processes that have attained any degree of commercial success. What the future may bring forth is hard to forecast.

Since Sabatier first attracted the attention of chemists to the powerful hydrogen-carrying properties of catalytic nickel, there have been numerous suggestions directed to the hydrogenation of petroleum. Most of these have been offered without a full realization of the sensitiveness of catalytic nickel to unfavorable conditions and particularly to the action of certain bodies (poisons), such as sulphur, which destroy catalytic activity.

The reaction between steam and metals—for example: nickel, chromium and iron—to produce energized or "nascent" hydrogen is the basis of a large number of methods whose object is to bring about a reaction between the hydrogen and hydrocarbons in the state of transition. Steam, however, itself does not have any direct hydrogenating effect, although this is sometimes ascribed to it.

Petroleum oils may be treated with anhydrous aluminum chloride to produce gasoline, either in the liquid or vapor phase, although most of the development work has been along the former lines. The cracking operations are generally carried out at atmospheric pressure and relatively low temperatures, in the neighborhood of 500 deg. F. The amount of aluminum chloride used is dependent both upon the character of the oil to be treated and upon several other factors, but in general will vary from 5 to 10 per cent of the weight of the oil. In order for the process to become of commercial importance, the aluminum chloride must be produced at a low initial cost or means must be devised for efficiently recovering or revivifying a large percentage of the catalyst and using it to treat fresh batches of oil. It is understood that the Gulf Refining Company recently, after spending millions of dollars in development work since 1913, so perfected the manufacture of aluminum chloride that we may expect this method to become an important contributory factor to our supplies of synthetic gasoline in the near future.

Vapor Phase Cracking—During the past year vapor phase cracking has come in for more attention than ever before for the revival of interest in this method of producing gasoline synthetically has been rapidly stimulated as the anti-knock value of the product has become more generally recognized. It is hardly possible that vapor phase cracking will supersede liquid phase, but it has a distinct function in supplementing existing operations by producing a high anti-knock fuel that may be used for blending purposes.

Much of the pioneering work in the cracking of oil was done in heating in the vapor phase under increased pressure. It will be remembered that over a decade ago the Federal Government itself became interested in this matter through the Bureau of Mines, and that much publicity was given to the Rittman process, the earliest work of which has been done under the auspices of the Bureau of Mines. Although this process was not a commercial success, due in part to premature publicity and construction of plants before all the details had been thoroughly worked out, nevertheless much credit is due Dr. W. Rittman and his associates for their pioneer research in thermal decomposition of hydrocarbons.

Among the problems that have had to be faced in developing vapor phase cracking on a commercial basis have been:

1. Deposition of carbon on the heating surface. This can be largely overcome by maintaining very high vapor velocities through the cracking tubes (of the order of 200 ft. per second) and by careful temperature control.
2. Excessive formation of fixed gases. Fortunately these gases have a very high heat value (1500-1800 B.t.u. per cu.ft.) and good illuminating properties, and can be used in the gas industry for enriching water gas. These gases are also rich in unsaturates and are therefore an ideal raw material for chemical synthesis. Considerable research work is being done by the larger oil companies looking toward the production of various alcohols, alkyl chlorides, esters, aldehydes and ketones from these gases, and it has been stated that this field has possibilities of equalizing or surpassing the industry built up around coal tar in the magnitude and variety of the products.
3. Mechanical difficulties in superheating the vapors uniformly and economically to a high temperature.

4. High fuel consumption.
5. Difficulties in accurate temperature control.
6. Difficulties in treating the distillate because of the presence of diolefines and other refractory compounds. It is claimed that this problem has been solved by vapor phase treatment with fuller's earth, and by a combination of sulphuric acid with silica gel.

Among the vapor phase processes that have attracted considerable attention in the past might be mentioned the Hall, Greenstreet, Alexander, Parker, Ramage, Knox (Petroleum Conversion Corporation), Forward and the processes of the General Petroleum Corporation and the New England Oil Refining Company. None of these processes has been developed on a large commercial scale owing in some cases to the economic conditions and in others to defects inherent in the processes themselves.

Probably the vapor phase processes that are being discussed the most at the present time are the "Gyro" process, sponsored by the Pure Oil Company, the Gulf-Texas process and the Leamon process. A number of "Gyro" units, an outgrowth of the Ramage process, are being installed in the United States and Canada. This process operates at atmospheric pressure. It is interesting to note that while the trend in liquid phase cracking processes seems to be toward constantly higher pressures, in vapor phase cracking the general tendency appears to be toward low pressures approaching atmospheric. In brief, the operation of the "Gyro" process is as follows:

The charging oil, after being contacted with the cracked vapors to "shock chill" them and at the same time to effect a preheating of the oil itself to about 500 deg. F., is passed through a tube still, where it is brought to a temperature (650-700 deg. F.) that will vaporize the fractions of the oil it is desired to process. The oil is then discharged into an evaporator where the unvaporized portions are removed as fuel oil. In the evaporator 3 per cent by weight of steam is added. The mixture of vapors and steam then pass to a convertor unit which, in the latest design, is made up of 4-in. O. D. tubular heating elements; the temperature is raised to about 1125 deg. F. A catalyst, consisting of a cylindrical core of concrete impregnated with iron oxide, is used in the convertor tubes. The vapors, after having been chilled in the tar leg, are passed through a fractionating tower and condensers. Provision is made for recycling the heavy ends from the fractionating tower. It is claimed that the following yields are obtained from Cabin Creek gas oil: Anti-knock gasoline, 55 per cent; fuel oil, 20 per cent; fixed gas, 25 per cent. As in most vapor phase processes, the fuel consumption is high, approximately 20 to 25 per cent of the charge. The standard unit has a rated capacity of 1,000 barrels of fresh charging stock per day.

The largest installation of the Leamon process is at the Interocean Oil Company, Baltimore, Md. This process is a vapor phase catalytic process operating at atmospheric pressure, the products from the unit proper being fuel oil, fixed gas and naphtha, which is rerun and treated to yield "Stellarene" gasoline.

The charge oil, mixed with the reflux from the fractionating column, is preheated in an exchanger by the vapors and gas from the catalytic chamber and then pumped through a pipe heater made up of Foster elements where it is heated to about 800 deg. F. and discharged into a vaporizing chamber. In the vaporizer the heavier fractions are dropped out and withdrawn from the system, while the vapors are returned to another section of the heater maintained at a higher temperature, where they are superheated to about 1,000 deg. F. The vapors then pass through a catalytic chamber, which in a unit producing 250 barrels per day of finished gasoline is a 10-ft. x 15-ft. cylindrical shell, equipped with grates carrying the catalyst. Leaving the catalyst chamber, the vapors and fixed gas flow through the heat exchangers, fractionating chamber and condenser. It is claimed that, both in the Leamon and "Gyro" process, practically no coke is formed. The yield, based on the fresh oil charged and including the gasoline recovered from the fixed gases, is stated to lie between 40 and 60 per cent. Fixed gas approximates 20 per cent of the charge.

The Gulf Refining Company and the Texas Company have recently pooled their vapor phase cracking patents and are carrying out a joint research and development program at the Bayonne refinery of the Gulf under Luis de Florez. This process is not radically different from several other vapor phase processes, except that no catalyst is used. The writer is not free to publish details of this process at the present time.

It is interesting to note the wide difference of opinion among petroleum technologists as to what are the most favorable conditions, particularly as regards temperature and pressure, under which to operate a vapor phase process. Most of the vapor phase processes that have made their debut in the cracking industry have been designed to operate at high temperatures (1000 deg. to 1200 deg. F. when running for gasoline) although several vapor phase units are now operating, apparently successfully, at relatively low temperatures, in the neighborhood of 850 deg. F. It is to be hoped that an exhaustive laboratory study of vapor phase cracking for different grades of oil will be made in the near future, which will clear up many of the essential points about which there is now much conflicting opinion.

Vapor-Phase Cracking Unit of the Gyro Process at the Cabin Creek, West Virginia, Refinery of the Pure Oil Company

Corrosion and Nitrogen Economics Reviewed at Swampscott

Editorial Staff Report

EDITOR'S NOTE: *From an industrial viewpoint, chief interest in the American Chemical Society's sessions at Swampscott, Mass., during the week of September 10 centered in two symposia before the Industrial Division. These discussions on corrosion and the economics of nitrogen production and consumption have been summarized in the following brief reports.*

Discuss Methods and Materials for Reducing Corrosion

INHIBITORS and the mechanism of their effect in diminishing corrosion rates was the principal subject brought up at the meeting of the Industrial Division on September 11 at which R. J. McKay of the International Nickel Company presided and also led the discussion. Viewpoints were expressed also, on such phases of corrosion as passivity and naturally developed protective films, the effect on the galvanic behavior of metals of the corroding solution, the methods of examination and evaluation of corrosion tests, and the relation of corrosion to physical strain and failure.

Several interesting points were brought out in the papers by H. O. Forrest, J. K. Roberts, and B. E. Roetheli, entitled respectively, "The effect of inhibitors on the acid solution of copper and copper alloys" and "The effect of additions of lime and soda ash to brackish water on the corrosion of iron and steel." Inhibition was effective in the case of copper and copper-zinc alloys exposed to hydrochloric acid only in the higher concentrations of acid where the evolution of hydrogen was pronounced. At 75 deg. C. this range was above about 20 per cent and at 20 deg. C. about 25 per cent. The minimum concentration of inhibitor necessary for effectiveness was not related to the temperature. The inhibitive effect of lime and alkaline additions is due, according to these authors, to the precipitation of a calcium carbonate scale on the metal surface, such precipitation occurring only from solutions on the alkaline side. The addition of lime to a calcium bicarbonate water is inhibitive.

An inhibitor that is very effective in dilute acids and neutral aqueous solutions and yet is soluble in organic solvents like benzene and alcohol was mentioned by W. S. Calcott of the duPont company. This inhibitor had the property of changing the polarity of an iron-zinc couple from the normal relation, where zinc was anodic, to the reverse, where iron was anodic. It was found that 0.01 milligram of inhibitor per sq.in. of iron surface was necessary for inhibition. H. A. Bedworth pointed out that the corrosion of deoxidized copper in neutral sodium chloride and calcium chloride brines can be decreased by one-half by the addition of 0.1 per cent of caustic soda. With the addition of the same amount of hydrochloric acid the corrosion rate is increased several times, the increase being greater in the case of calcium chloride.

In the discussion, the warning of Evans was recalled to the effect that there is the danger at times of serious localized corrosion in the use of inhibitors. Just what conditions will bring this about are not understood as yet, due to the limited knowledge of the chemistry of inhibition. The tin salts that are derived from the corrosion of tin-cans, according to E. F. Kohman of the laboratories of the National Canners Association, are in the nature of inhibitors in that their presence has a preventive effect on further corrosion within the can.

In a paper, "Submerged Corrosion," by H. O. Forrest, J. K. Roberts, and N. Hamilton, a method of testing was described which took into consideration the fact that stable corrosion rates often were not reached for some time after the metal was exposed, due to interference of the original progress of corrosion by accumulations of corrosion products. Aerated and agitated tests on duplicate specimens of iron and steel were run for 80 days and more, the specimens being removed one by one as the test progressed. The slope of the curves derived from plotting the weight losses against duration was an indication of the corrosion rate at any time. Whereas the slope of the curves for wrought iron and steel specimens became constant after 15 days more or less, those for cast iron were still varying after 150 days, an inconsistency reflecting an obstructive corrosion product condition.

The electrochemical behavior of Alclad was discussed by E. H. Dix. In this product, surface layers of pure aluminum are rolled on strong aluminum alloy sheet in such a way that the corrosion resistance of pure aluminum is realized for the combination. The galvanic relation between aluminum and the alloy effects protection of the alloy at cut edges, and of alloy rivets used in conjunction with the sheet.

The galvanic behavior of the tin and iron in tin-cans, it was pointed out by Kohman, depends on the nature of the contents of the can. Whereas iron is anodic to tin in the standard electro-potential measurements and in the presence of air, frequently the reverse is true in the tin-can. The polarity of an iron-tin couple can be reversed by a change in the hydrogen-ion concentration.

In the discussion on passivity it was brought out that an oxide film was believed by many to be the cause of passivity, and that Evans had managed to isolate and make visible such a film developed on iron. Others feel that a modification of the surface layer of metal itself is the seat of passivity, and still others that the presence or absence of a gas film of hydrogen determines the activity or passivity of the metal. A case of passivity

developed by a chromium-iron alloy against sulphuric acid was described by L. L. Satler; a plate of the metal subjected to the splash of pickling acid remained unattacked after several months, in spite of the ordinary poor resistance of such an alloy to sulphuric.

McAdam's recent papers on corrosion fatigue were recognized in the discussion as being of great value. These deal with the corrosion of stressed metal as it affects mechanical properties. The remark was made that there appeared to be no available results to show the effect of stressing metal on the rate of corrosion. Jerome Strauss expressed the belief that strained metal is not likely to suffer greater corrosion than unstrained, and Dix mentioned that hard-rolled aluminum in one case seemed to be less subject to corrosion, for some reason—possibly an external condition—than annealed. Work-strained metal in galvanic contact with unstrained, according to McKay, had in one case been anodic.

Of the recent developments in the alloy line, C. E. MacQuigg believed that the nickel-chromium-iron alloys, with and without molybdenum, were of the greatest practical significance, particularly to the chemical industries.

Economics of Nitrogen in Chemical Industry

ONE of the most interesting and valuable symposia of recent years was that on Nitrogen Economics, held by the Industrial Division on September 12 under the chairmanship of Williams Haynes.

Under the title, "The New Place of Nitrogen in Chemical Economics," Jasper E. Crane, president of the duPont National Ammonia Company, discussed the present status and probable future of nitrogen supply and demand, with particular reference to the United States. Prices of nitrogen compounds are decreasing, and the rapidly expanding production through the synthetic ammonia process will insure an increased supply at low prices. Cheap nitrogen already is a fact, and the extensive program now under way will insure for the United States an independent supply for all needs.

Mr. Crane characterized Muscle Shoals as being economically unsound as a source of nitrogen supply, since the cyanamide process, for which Muscle Shoals is equipped, cannot be worked as cheaply as the direct synthetic ammonia process. The most important factor in the cost of synthetic ammonia is the production of hydrogen, and he held that water power is too expensive, at least in this country, as a means of making hydrogen from water. Among the essentials for operating economy are cheap fuel, advantageous location of plant, large scale of operation, ample capital and skilled workers. Even then the unit profit will be small.

EXECUTIVES who have been responsible for the investment of millions in synthetic ammonia plants in this country are also facing the threat of extremely rapid obsolescence. E. M. Allen, president of the Mathieson Alkali Works, declared that operating practice of three to five years ago is now of little value—in fact, six to twelve months is the order of change in the ammonia industry and every new plant represents a decided improvement over all existing installations. The industry must meet this threat by continuous modernization of both production and distribution machinery.

In outlining the present marketing problems of the ammonia industry, Mr. Allen estimated that the output of ammonia as liquor will remain at 30,000,000 to 35,000,000 lb. per year, and that nitric acid alone will require 150,000,000 lb. per year, explosives 70,000,000, lb. per year, the soda industry from 7,000,000 to 10,000,000 lb. per year, and the chamber sulphuric acid industry 3,000,000 lb. per year. Marketing costs are not being reduced in proportion to producing costs, and in the opinion of Mr. Allen, the more extensive use of larger shipping containers must be realized. Unquestionably the largest future use of ammonia will be in the fertilizer industry, and Mr. Allen remarked that Government funds might better be expended in educating the farmer to use the new concentrated nitrogen fertilizers, rather than attempt to produce fertilizers in competition with private industry. Since the United States already is secure as to nitrogen supply, Mr. Allen said that the Muscle Shoals nitrate plant is non-essential, even in time of war. It is, he declared, merely a "chemical ghost," disinterred periodically for political purposes.

H. R. Bates, manager of manufacturing for the International Agricultural Corporation, compared the world resources of nitrogen before and after the War. In 1913 Chile nitrate supplied 429,897 tons of nitrogen; byproduct ammonia, 319,667 tons; synthetic ammonia, 90,491 tons; total, 840,055 tons of nitrogen. In 1927 synthetic ammonia supplied 700,000 tons of nitrogen; Norway saltpeter, 30,000 tons; cyanamide, 200,000 tons; byproduct ammonia, 370,000 tons; Chile nitrate 320,000 tons; total, 1,620,000 tons nitrogen. There should be no fear of nitrogen over-supply, since in American farming practice only about 6 per cent of the nitrogen removed by crops is being replaced by inorganic nitrogen fertilizers. The future of fertilizer nitrogen demand is therefore bright, although it is apparent that the fertilizer industry will become increasingly dependent upon the chemical manufacturer for the concentrated plant foods which agriculture demands.

C. J. Ramsburg, vice-president of the Koppers Company, discussed present conditions in the byproduct ammonia industry. The nitrogen equivalent of byproduct ammonia is about 150,000 tons per year, a quantity greater than the estimated war-time requirements. Sulphate of ammonia is likely to continue as the predominating form of byproduct ammonia, although other salts could be prepared. The future supply of byproduct ammonia will continue to increase, although not as rapidly as in the past. In fact future demand for nitrogen will increase so rapidly that other sources must supply the deficiency.

In the concluding paper of the symposium, W. S. Landis, vice-president of the American Cyanamid Company, contrasted nitrogen market conditions in this country and in Europe. Whereas in Europe an increased use of nitrogen means a reduction in the imports of foodstuffs, the same practice in this country, would, under our present scheme, tend to produce surpluses which have lower value than for normal rates of production. Consequently Mr. Landis believes that the American nitrogen industry offers possibilities only to those producers of certain nitrogen compounds that are adapted to our peculiar agricultural needs, and which must be sold relatively cheaply since our level of farm prices is always lower than that in Europe—at least to the extent of ocean freight from this country and subsequent handling charges.

Chemical Engineering Advances Acidophilus Therapy

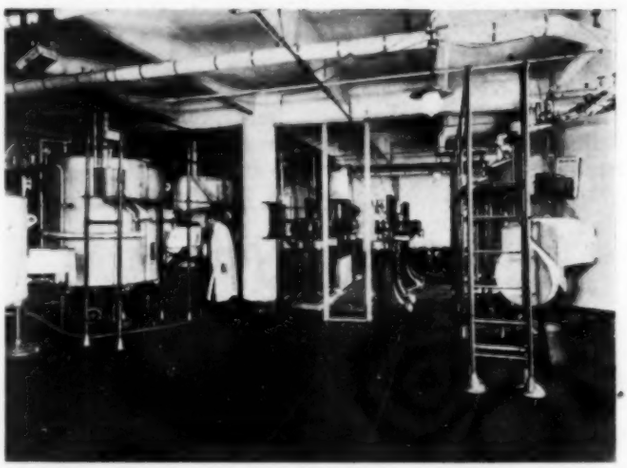
By Theodore R. Olive
Assistant Editor, Chem. & Met.

WHEN A MAN fell ill a few hundred years ago, he was believed to be possessed of a demon and was properly exorcised. If his natural resistance sufficed, he recovered; otherwise, between the exorciser and the devil he strove to dislodge, the unfortunate patient was neatly, but not always pleasantly, dispatched. Then came Pasteur and his discovery of not one demon, but myriads at the root of most that was ill as well as good in living processes in the environment of man. Since Pasteur's time this young but precocious science of bacteriology has learned much and yet strives to learn a great deal more of these myriad devils, the bacteria. A fascinating story of the way a bacteriologist has put his knowledge to work with the help of chemical engineering is bound up in a new laboratory of the H. K. Mulford Company at Philadelphia, where B. acidophilus blocks are manufactured.

In the first chapters of the story, the chemical engineer is necessarily a bystander and it is only in the dénouement that he has his innings. Nevertheless, the first chapters are necessary to a fuller appreciation of the last, because here, as will become increasingly true in many processes now in their infancy, the chemical engineer must work hand in hand with the bacteriologist.

EARLY in the present century, Metchnikoff correlated the notably long life of Bulgarian peasants with their custom of drinking sour milk. He proceeded to isolate a lactic acid bacterium, B. bulgaricus, whereupon his followers foresaw the millennium and advertised the bacillus as a new fountain of youth. The heralding proved to be premature, however, when it was found that the numerous B. bulgaricus cultures that appeared upon the market possessed as their sole virtue the ability to sour milk. Metchnikoff had given credit to the wrong bacterium. This was demonstrated in 1920 by Cheplin and Rettger, who showed also that another organism, Lactobacillus acidophilus, very similar in appearance to B. bulgaricus, but very different in its behavior in the human intestine, was actually the benevolent factor in the treatment of intestinal toxemias.

Where Seed Cultures Are Aseptically Grown at Blood Temperature

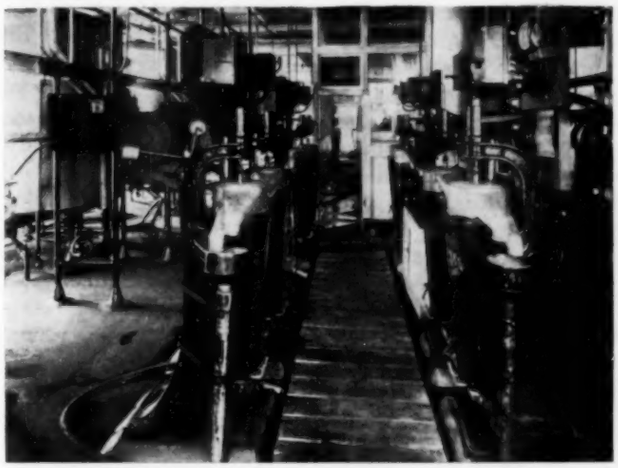


Large Scale Culture Tanks With Separation Equipment in the Rear

This bacillus was originally discovered as an intestinal inhabitant by Moro in 1900. It thrives upon carbohydrates but is totally unable to utilize protein material as a source of energy. On the other hand, pernicious bacteria, such as constitute 95 per cent of the intestinal population of the average adult, derive their energy from nitrogenous substances. These bacilli, through putrefactive processes, generate cumulative poisons from the proteins in the intestine and probably bring about actual ill health and eventual senility.

THAT NATURE does not intend intestinal flora to be poison-producing is evident since the nurseling possesses practically none of the putrefactive bacteria. His milk diet guarantees this, for, of all carbohydrates, only two are slowly enough absorbed by digestive processes to reach the colon, and of these the infant receives one, lactose, in quantity. The civilized adult ingests little lactose, however, for it occurs only in milk, and the other slowly absorbed carbohydrate, dextrine, forms but a small part of his diet. The result is that as the diet becomes dominated by proteins with increase in age, B. acidophilus is mainly displaced from the intestine by the proteolytic bacteria.

It has been shown that bacteria can produce poisons only from protein material and only in an alkaline environment. No bacterium can cause putrefaction with a carbohydrate energy source. Hence, if the host can provide carbohydrates in sufficient quantity at the proper



Battery of Super-Centrifuges Used to Separate Bacilli From Trypsin Digest

point, that becomes another matter, for the acidophilus bacillus is given its chance. With carbohydrates as its raw material, it builds up the acidity of the intestine and in turn displaces the greater part of the proteolytic bacteria. The average adult shows an intestinal pH of 7.5 to 8 as a result of his undesirable intestinal germ picture. It is highly desirable that the fecal pH approach 6 to 6.8, as found in the infant.

Here lies the basis of acidophilus therapy. If sufficient amounts of lactose or dextrine (8 to 10 ounces daily) could be ingested, the change in flora would usually take care of itself. But this procedure is highly impracticable. Rather, it is preferable that the B. acidophilus should be implanted in the colon in large enough numbers, along with sufficient suitable carbohydrate, to bring about the desired change. Once this is accomplished, the condition may persist indefinitely with proper diet. This brings acidophilus milk into the limelight, for such cultured milk provides both the bacilli and the lactose. But 500 to 1,000 c.c. per day must be taken, and this, to many people, is discouraging. The problem becomes one of separating the two requisites from their disagreeable features; and here chemical engineering takes the stage.

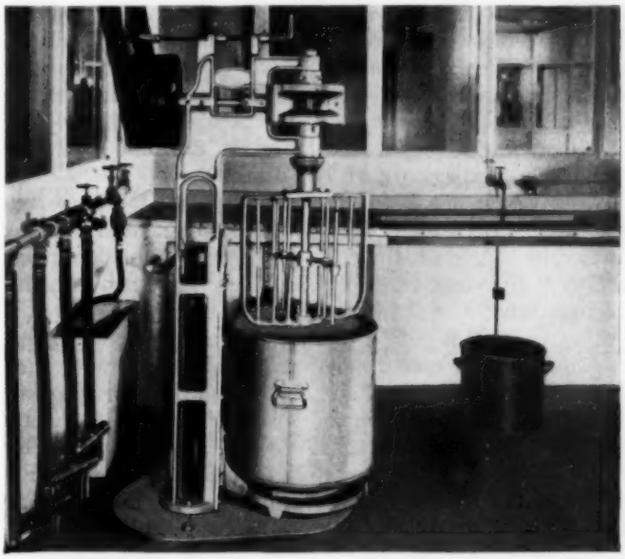
The H. K. Mulford Company recognized the problem and obtained the services of H. A. Cheplin, one of the pioneers in acidophilus therapy. Under his supervision a method was worked out which resulted in the building, two years ago, of a plant for making acidophilus bacillus blocks. The venture has been so satisfactory that plant capacity has recently been doubled, demonstrating once more that a complicated bacteriological problem may yield to mass production under the hand of the bacteriologist and the chemical engineer.

Operative Removing Bacillus Paste from a Centrifuge Bowl

Very briefly, the operation consists in the isolation and propagation of suitable strains of B. acidophilus, the making of trypsin digest milk cultures, the separation of the bacilli from this medium, and the final incorporation of the bacillus concentrate in agar jelly with sufficient lactose to provide nourishment for the organisms, giving a palatable and easily administered product. About 30 operatives are actively employed in the manufacture of these acidophilus blocks. The processes are so scheduled that only one shift per day is necessary.

Naturally, all operations are carried out under the most aseptic conditions. Preparation of the "seed" culture and absolute control of every step in the manufacturing processes are in the hands of bacteriologists, headed by Dr. Cheplin. Hardy strains of adaptable acidophilus bacilli are re-isolated at intervals to insure continuity of the desirable properties.

The process has its inception in the preparation of the seed culture. By careful control of this operation the complete elimination of undesirable bacteria is accomplished. A few c.c. of a sterilized trypsin digest of skim milk is inoculated with the bacilli. After an incubation period of 20 hours at blood temperature, taking place in a temperature controlled room, the small amount of culture is split between two considerably larger quantities of trypsin digest. Another incubation period follows, after which the larger batches, totaling one liter each, are split between twelve 18-liter batches of the digested milk and again incubated. It is found that these quantities represent optimum inoculations for maximum growth in the minimum period of time. Portions of the seed culture so produced are retained for further seed production while the bulk of the culture is delivered to the full scale manufacturing process.



Monel Tank Where the Bacillus Paste Is Mixed With Milk

Meanwhile, the full scale culture tanks have been prepared. There are ten of these, of glass enameled, jacketed and insulated construction, each of 1,000 gal. capacity, equipped with a propeller agitator extending through the side of the tank. Overhead runways make

Monel Kettles Where the Agar Jelly is Prepared

the tank tops accessible. A novel method is used to maintain the jacket water at the desired temperature. Water at 100 deg. F. is supplied to the jackets from an external source. Then, by means of a thermo-syphon system in which a gas flame plays upon an unlagged fitting at the lowest point in a line connecting the bottom and top of the jacket, the water is maintained at the incubation temperature of 100 deg. F.

Milk which has been specially skimmed to insure removal of all cream is received at the plant in regulation milk cans. A small tin plated sanitary pump withdraws the milk and discharges it through sanitary pipes to the various tanks. A tank charge of 1,000 gal. is rapidly heated to 220 deg. F. for sterilization, after which, by the admission of cold water to the jacket, the temperature is reduced to 120 deg. F. Caustic soda is used to bring the pH to 8.2, when trypsin is added and the tank contents allowed to remain at 120 deg. F. over night. The following day the digested milk is neutralized, and again sterilized at 230 deg. F. for two hours. The temperature this time is lowered to 100 deg. F. and seed culture, to the amount of 5 per cent of the trypsin milk digest, is aseptically introduced into the tank. The temperature is closely maintained at 100 deg. for 20 hours, after which the culture is ready for centrifugal separation.

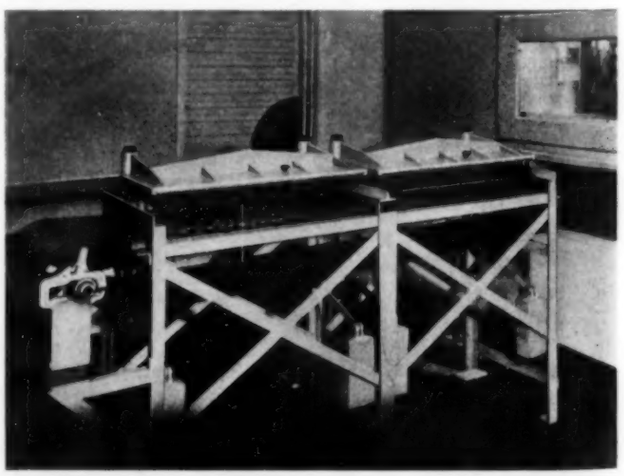
SEPARATION EQUIPMENT consists of a battery of 16 Sharples super-centrifuges provided with Monel metal bowls. It is to be noted that the culture may come in contact only with glass, Monel, nickel, aluminum and block tin. Only Monel piping is employed for the tank-to-separator connections.

Eight super-centrifuges are used simultaneously in the discharge of a single tank. The contents of 1,000 gal. may thus be centrifugalized in about two hours. The bacilli are retained in the centrifuge bowls as a putty-like mass while the effluent, a watery trypsin digest, being worthless, is discharged to the sewer.

The bowls, when a batch has been separated, are taken to a special room where the mass of acidophilus bacilli is carefully removed from each with a rubber spatula. About 20 pounds of bacterial mass results from one 1,000 gal. batch of culture. Four 1,000-gal. batches of culture per day constitute the plant capacity. The acidophilus mass is then carried to an adjoining room where it is mixed to a homogeneous, concentrated suspension with sterile, undigested sweet skim milk to a total of 10 gal., in a 30-gal. Monel tank provided with agitation. During this operation an agar jelly is prepared nearby in two 100-gal. jacketed Monel kettles. The jelly consists of agar, cane sugar, glucose and lactose and is carefully held at 42 deg. C. while the concentrated suspension of the acidophilus bacilli is added to the kettle. A higher temperature would kill the bacilli while a lower would permit premature solidification of the agar jelly. The kettles are then discharged through a short Monel pipe into chilled Monel molds placed in an adjoining room that is held at 65 to 70 deg. F. Operations in this room, as well as those which follow, are supplied with washed air humidified to 55 to 65 per cent.

THE MOLDS each form eight agar layers and on cooling for an hour are taken apart and the layers removed to a foot-operated press. Here a reticulated knife, also of Monel and resembling a square-celled honeycomb, is pressed into each individual agar layer to divide it into 480 rectangular blocks. The knife is transported with the cake to a support above a sterile conveyor belt where descending Monel punches extract the alternate blocks simultaneously and drop them upon the belt in a checkerboard pattern. A second descent of the punches removes the remaining blocks, which likewise drop upon the belt so that no block touches its neighbor. The belt carries the blocks through a chocolate enrober to give them a thin, palatable chocolate covering that at the same time retards desiccation. The blocks emerge from the enrober to enter a cooling tunnel where a temperature of 60 to 65 deg. F. is maintained. The conveyor discharges them finally to the packing room, refrigerated to 58 deg. F. where operatives wrap the blocks individually in tin foil and pack them in dozens, ready for the trade. The product is finally stored at 40 deg. F. not longer than through the succeeding night, after which the boxes are mailed directly to the ultimate consumer with the assurance that, for six weeks at least, if properly kept, a large proportion of the 150,000,000,000 bacilli in every block, equivalent to a pint of acidophilus milk, will be ready and willing to work in the cause of human intestinal improvement.

The writer wishes to acknowledge his indebtedness to the H. K. Mulford Company and particularly to Harry A. Cheplin for the latter's enthusiastic assistance in the preparation of this account.



Punch Press Over the Sterile Belt Where Bacillus Blocks Are Removed From the Knives and Carried by Belt to the Enrober

Safety Congress Studies Hazards in Chemical Manufacture

Editorial Staff Report

PROCESS industries had an important part in the sessions of the Seventeenth Annual Safety Congress held in New York October 1 to 5. The chemical section of the National Safety Council held four sessions at which the attention of several hundred representatives of chemical industry was directed toward the solution of its safety problems—particularly process hazards, chemical burns, benzol and other industrial poisoning. Likewise the safety theme was intensively studied in sections representing the rubber, petroleum, paper and pulp, cement and food industries. Through the Council's offices in Chicago the reports on this discussion are shortly to be available on request.

Following the opening luncheon on October 1, Chairman Leonard Greenburg of the Chemical Section introduced H. C. Parmelee, editor of *Chem. & Met.* and *Food Industries*, who discussed the safety responsibilities of the chemical engineering industries. The speaker declared that, since information and equipment are now available for combating practically all the hazards inherent to chemical manufacture, this availability places a responsibility at the door of the industry. Unless it is willing to put its own house in order, it may be expected to be forced to do so by the government. Self regulation in such matters is always to be preferred to bureaucracy, no matter how intelligently or sympathetically the latter is applied. In addition to the responsibility to itself, the industry has a greater ethical obligation to the general public. Mr. Parmelee emphasized the manufacturer's responsibility in placing a dangerous product in the hands of the consumers without adequate precautions and regulations.

A new field in chemical engineering offering a real problem for the safety engineer is the high pressure technique involved in the manufacture of synthetic ammonia and methanol. The use of pressures as high as 15,000 lb. per sq.in. and temperatures up to 700 deg. C. has had to wait upon the development of better materials of construction and a new technique in their fabrication. Welding procedure has now made possible not only better designed equipment but has also permitted the testing of equipment so that the actual factors of safety are accurately determined. This sort of inspection, absolutely essential under such conditions, should be more generally applied in older chemical engineering industries, according to Mr. Parmelee.

A round-table discussion, under the chairmanship of John S. Shaw of the Hercules Powder Company, brought out a number of general aspects of the safety situation as well as several specific solutions for chemical plant hazards. John Roach, for many years an official of the New Jersey Department of Labor, remarked on the constant improvement of the industry in his state due to reduction in contact and structural risks and to more competent supervision of plants. Lewis A. DeBlois, speaking from the viewpoint of the underwriter, indicated that insurance companies are less alarmed about chemical industry than about the situation in construction and other older fields in which safety is not yet as well recognized. Rates faithfully reflect accident experience and the even tenor of most chemical rates indicates a sound condition. As a word of precaution, however, Mr. DeBlois stressed the necessity for better maintenance and inspection, particularly in new processes where the hazards from corrosion and other factors are yet unknown. John Spicer of the Pennsylvania Labor Department declared that the accident rate in his state is being reduced by better organization of safety work through close co-operation between the State Department and the safety engineers of the industry.

AMONG the safety problems which the industry has met and solved recently was an accident cited by A. L. Armstrong of the Eastman Kodak Company. Four steel drums containing 92 per cent sulphuric acid had been stored on the third floor of a building. Several months later a crew of men removed two of the drums safely but the third exploded with disastrous consequences, killing one man instantly and causing the subsequent death of two others from acid burns. Laboratory tests made after the accident indicated that drums exposed to 92 per cent sulphuric acid might lose as much as 14 lb. during several months storage. It was assumed, therefore, that the hydrogen generated by corrosive action had been exploded by a spark.

E. C. Rogers of the Grasselli Chemical Company, who was also familiar with this accident, said that although the bungs of the drums had been loosened at the time they were stored they had become so badly sulphated as a result of corrosion as to prevent any escape of the gas generated. Furthermore the drums had been filled in cool weather and were stored in a room where the temperature reached 90 deg. F. It was questionable, therefore, that sufficient outing had been provided. To prevent similar occurrences a special blow-out plug with a foil diaphragm releasing at 25 lb. has been designed for use in drums during storage. It is apparent, however, that shipping containers should not be used for storage purposes.

A recent accident in a carbon products plant in New York State emphasized the extreme explosibility of pitch dust. For twenty-five years this material had been handled by electrode manufacturers without accident but during the last two or three years there have been at least three serious explosions (see *Chem. & Met.* Vol. 35, p. 122 and 139). In the New York plant a bucket ele-

vator containing pitch dust was being repaired when it broke and dropped on an electric wire and lamp which ignited the dust. One man was killed and another injured. To prevent similar occurrences electrode manufacturers have since introduced a number of safeguards.

George Miller, safety engineer of the du Pont company, spoke of the hazards of nitrogen oxide fumes such as are produced from water coming into contact with mixed acid. The poison is insidious in effect, seldom immediately fatal but often resulting in casualties from pulmonary oedema. Since workmen can not judge concentrations that may prove dangerous, they are given instructions to leave the scene immediately and return only when properly protected by gas masks. The du Pont company has prepared a pamphlet on safe practice in cleaning acid tanks. Similar precautionary measures used by the Hercules Powder Company were stressed by Mr. Sperry, safety engineer of that company.

J. H. SHAPLEIGH, chemical engineer, Hercules Powder Company, spoke on safety in gaging and sampling at the second session of the chemical section on October 2. He said that these processes are too hazardous for setting up any general procedure. Each material handled should be examined for its effect under various conditions, for its physical as well as chemical properties. Such considerations as the effects of dilution or of freezing or of temperature and pressure change should be considered. As an example, molten niter cake entails expansion of the line through which it is pumped. Other factors to be considered are volatility, dilution through condensation, or freezing of the container.

Gaging devices should permit the operation of a plant in a safe and economical manner. There are four types of gages, of which the float, pneumatic, sight glass and measuring rod are representative. The float may stick. The pneumatic gage is often too delicate for corrosive conditions. Sight glasses are widely used and are not particularly dangerous; the chief hazard is in the connection below the liquor level. Safety screens may be used when the gage is under pressure. The measuring rod is perhaps the most exact but the application is limited to gaging at atmospheric pressure.

In sampling, both the material and the location of the sampling point must be considered. The latter should allow easy egress in two or more directions. Unless free from vapor, hoods should be provided for the sampling place. As sampling valves are subject to abuse, the equipment must be properly maintained. Sampling of solids ordinarily involves the use of machinery. Such samples must be taken from a suitable place and not, for example, from a hazardous point in the process.

Dr. Frank P. Underhill of the Yale Medical School, who was in charge of experimental work on toxic gases during the War, spoke of the treatment of the effects of superficial burns and irritant gases. Although apparently unrelated, these effects are fundamentally alike. Both act upon the mucous membrane of the respiratory system or that beneath the skin. Under normal conditions there is little fluid passing through the membrane since its permeability is low. Irritation, however, increases the permeability and a watery dilute plasma separates from the blood and exudes through the tissue in an effort to alleviate the irritation. This response is very rapid after irritation. The loss of plasma from the blood results in blood concentration while the plasma tends to fill the lungs and may often result in drowning the patient. With the increase in concentration of the blood, heart action becomes sluggish and the blood is no longer an efficient oxygen carrier.

The treatment in general consists in giving the patient rest and, keeping him warm, meanwhile administering a large amount of fluids. The use of neutralizing gases or solutions may make the affection worse and is to be avoided.

SUPERFICIAL burns also concentrate the blood, and if this can be prevented recovery is aided. Treatment consists in care of the wound as well as control of blood concentration. This control is accomplished by ingestion of large amounts of water. Chemical burns should be flushed with water alone and should not be neutralized. Of course, if the burning agent is insoluble in water other materials may be used. Neutralization usually is ineffective because the damage is done immediately.

Dr. C. T. Graham-Rogers of the New York State Department of Labor spoke of that department's classification of chemical risks. He said that the chemical industry often exaggerated its own health hazards. Dr. C. H. Gehrmann, medical director of the du Pont company deplored the lack of knowledge of present-day health hazards in industry, meanwhile reminding the section that in non-hazardous occupations preventive medicine has increased the expectancy of life from 20 to 50 years. He remarked that there are three types of hazards in chemical plants: 1. Absorption through the skin as exemplified by aniline and tetra-ethyl lead; 2. Entry through the respiratory tract of dust or vapor; and 3. Ingestion through the digestive tract. He emphasized the necessity for having a complete history of the employee at the time of his employment and for keeping a close watch afterwards. He said that his company classifies the groups under different hazards by the intervals necessary between examination. These intervals may range from one week to one year.

The next speaker, Walter S. Paine of the Aetna Life Insurance Company, emphasized the necessity for educating individuals and cited the work done by a number of insurance companies.

The session was followed by a luncheon at which a number of speakers gave their views on benzol poisoning. Among those who spoke were Mr. Gumaer of the Barrett Company, Dr. Wright of the Metropolitan Life Insurance Company, Prof. Smith of the University of Pennsylvania, Dr. Alice Hamilton of Harvard and Dr. C. E. A. Winslow of Yale, the Council's vice-president in charge of health. All emphasized the necessity for further study, particularly of the effects of impurities, which are thought to constitute by far the more toxic elements in this type of poisoning. The importance of good engineering in the design of ventilation and solvent recovery equipment was also stressed. From a medical standpoint there is likewise a great need for more complete clinical records in order to get at the question of individual susceptibility.

CONCLUDING sessions of the Chemical Section on October 3 were featured by a discussion of gas masks and respirators by Professor Yandell Henderson of Yale and a symposium of views on the safe handling of compressed gases. There are, according to Dr. Henderson, four types of gases met in the chemical industry, viz. (1) Asphyxiants such as "black damp" (methane), (2) Irritants such as sulphur dioxide and nitrogen oxides, (3) Volatile organic materials, such as chloroform and benzol, and (4) True poisons such as arsenated hydro-

gen and tetra-ethyl lead. To combat these we have three types of masks: viz. (1) The hose mask with connection for forcing fresh air to the exposed individual (Dr. Henderson's view that these should be used in all possible cases was roundly applauded), (2) The cannister mask with the charcoal-soda lime adsorbents, and (3) the self-contained oxygen mask. These are described in the A.C.S. monograph on "Noxious Gases" by Henderson and Haggard.

W. P. Yant of the U. S. Bureau of Mines stressed, in discussing Dr. Henderson's paper, the absolute necessity for care and systematic inspection of gas masks in order to prevent, or to detect the evidence of, deterioration. He also called attention to the fact that the industry has recently developed and improved the so-called respirator, which has been used satisfactorily in spray painting and in the silica industries. He warned, however, that it is not a panacea and that the right mask to meet the particular need is the only one to be recommended. As an example of the industrial importance of the gas mask, Mr. Yant cited a process of benzol-acetone wax extraction, which required a filter press operation in a dangerous acetone atmosphere. The process was only practicable when the correct gas mask was selected and used.

THREE speakers shared in discussing the safe handling of compressed gases. H. M. Mabey, traffic manager of the Mathieson Alkali Works, spoke of the benefits to the industry and the public that have resulted from the standardization of transportation requirements made possible by the promulgation of the "Dangerous Articles Regulations" of the Interstate Commerce Commission. Through co-operation within the industry it has gone beyond the bare letter of these regulations, and has interpreted the spirit of safety in transportation.

Major John C. Minor of the William Wharton, Jr., Steel Company, who has been associated with the industry both as a gas manufacturer and as a cylinder producer, told how the Compressed Gas Manufacturers' Association had co-operated in preparing regulations for the safe handling of cylinders. Bad practice in this regard is indicated by the following half dozen warnings: (1) Don't hoist a cylinder with a rope sling or a grab magnet. (2) Don't mix gases in cylinders. (A number of disastrous explosions have thus been caused) (3) Don't use a cylinder as a roller. (4) Don't heat a cylinder or subject it to sharp changes of temperature. (5) Don't use oil or grease around an oxygen valve. (6) Don't allow water to enter a gas cylinder, for this may cause freezing which will start an initial crack.

J. P. Banash, consulting engineer of Chicago, called attention to the National Safety Council's informational resources on these hazards. There is lacking, however, a table of the comparative fire and explosion hazards of gases comparable to similar studies of liquids and solids. There is also an opportunity for applying safe practice in piping gases in plants, particularly those under high pressure where leaks may lead to disastrous explosions.

Before adjourning the Chemical Section re-elected Dr. Greenburg, chairman, C. F. Whittemore of the Western Electric Company, vice-chairman. A. L. Armstrong of the Eastman Kodak Company was elected chairman of the executive committee. The new secretary is George E. Mitchell of the du Pont Rayon Company. It was announced that a mid-year meeting at some important chemical center will be held in March or April of next year.

Chemical Health Hazards in the Rubber Industry

By L. J. D. Healy

Technical Superintendent, Federal Division, The Fisk Rubber Company, Cudahy, Wis.

NEW chemicals for use in rubber manufacture are being continually developed with the result that an increasing number and variety of organic substances are being offered on the market, often to the confusion of the rubber manufacturer because of conflicting claims of the distributors. In this present age of competition, the accelerator manufacturer is only too anxious to get a promising accelerator on the market, often before adequate data have been obtained either as to its value for rubber work or as to the health hazards involved in the handling of the material. On the other hand, the rubber manufacturer, being only too anxious to improve his product, is often tempted to accept the exaggerated statements of accelerator salesmen, and jumps into production with an unknown and untried substance resulting in untold factory trouble, as well as possible injury to the health or comfort of the employees using these materials. Numerous cases of the latter have occurred during the past few years with the advent of organic accelerators and softeners.

In the "Safe Practice" pamphlets prepared by the Health Hazards Committee of the Rubber Section, and issued by the National Safety Council, we have endeavored to show the composition of these accelerators, their probable toxicity or irritant effect, and wherever possible suggestions for handling which will remove all hazards. We believe that if these suggestions are followed, but little, if any, hazard will be experienced in handling these compounds. In a few instances, the use of very toxic accelerators has been discouraged since with the large variety we have to choose from at the present time there can usually be found a suitable substitute.

Certain types of accelerators have more recently appeared to offset oxidation to a considerable extent and this has led to an intensive study of those particular organic groups which best resist oxidation. The search has resulted in this new body of organic compounds which have been named "anti-oxidants," and which promise to offer the next great advance in the vulcanization of rubber goods. They have been given considerable publicity and have come into quite general use during the past year. A canvass of the various rubber companies indicates that most of the latter are using or at least experimenting with one or more of these compounds.

These anti-oxidants are organic compounds similar in many respects to the organic accelerator group. There are approximately a half dozen of these anti-oxidants in quite general use. They are sold mostly under various trade names. Some of these compounds are derived from toxic bases and others are of such composition that those using them should be on the lookout for dermatitis. In general they are substances which can be safely handled with reasonable precautions. A study is being made of their toxic and irritant properties and as soon as this is completed, these substances will be classed as a subgroup under the accelerators and dry inorganic compounds in the National Safety Council's safe practice

Extracts from a paper read before the Rubber Section of the National Safety Council at the Seventeenth Annual Safety Congress in New York, October 3, 1928.

pamphlet. Sufficient data have not yet been accumulated in order to complete the anti-oxidant group at this time. However, for the benefit of those using these substances, the following list comprises those in most general use, together with their basic composition and probable toxic or irritant properties:

Age-rite powder: A gray powder melting at approximately 100 deg. C. and consisting of phenyl-betanaphthylamine. Probably slightly toxic and should be handled according to instructions noted under the naphthylamine group of accelerators.

Age-rite resin: A red resinous substance, brittle when cold and liquid at milling temperatures. Contains adol-alpha naphthylamine. General precautions as noted for the age-rite powder should apply.

Antox: A tan colored powder containing para-amino phenol. A combined accelerator and anti-oxidant. Used only to a limited extent. No trouble reported from its use. Possibility of slight dermatitis.

Neozone: A purplish gray waxy compound containing phenyl-alpha naphthylamine with meta toluene diamine and some acid wax. Quite safe to use with ordinary precautions. Probably slightly toxic. No danger of dust.

Oxynone: A light brown powder, oxidizing in moist air. It is an amine derivative, which should be handled with some care to prevent staining of the flesh or possible dermatitis. Should not be inhaled.

Resistox: An aldehyde condensation product in the form of a pinkish buff powder. No data as to toxicity but its general composition would indicate no hazard involved in its use.

Stabilit: A yellowish compound readily turning purple upon exposure. Consists of diphenyl ethylene diamine. Probably somewhat toxic but involving no hazard with careful use.

V. G. B.: A brown resinous powder consisting of acetaldehyde alpha naphthylamine. Only slightly toxic. Has been used in large quantities. No trouble other than slight dermatitis reported. Should not be inhaled.

A description of these compounds will later be issued to be appended to the accelerator and organic group. The Health Hazards Committee will gladly welcome any criticisms or suggestions concerning this work.

Isotherms and Isobars for Air Separation Studies

By Barnett F. Dodge

Department of Chemical Engineering, Yale University

STUDIES of processes for air separation by liquefaction methods must be based on the pressure-temperature-composition data for solutions of oxygen and nitrogen. The classical data in this field are those of Baly (*Phil. Mag.* V, 49:517). Baly's data covered a very limited field and have since been found to be considerably in error. Recently, the present author published the results of an extended investigation on the co-existing liquid and vapor phases of oxygen-nitrogen solutions (B. F. Dodge and A. K. Dunbar. *J. Am. Ch. Soc.*, 49, 501, 1927). This paper was confined to giving the experimental details, the actual observations, and a comparison of the observed data with the data of other investigators. It is the purpose of the present paper to present in tabular form certain data, calculated from the original data, which should be useful in engineering calculations. For example, isotherms for every 5 deg. C., from 75 deg. K. to 125 deg. K., as well as isobars for pressures from 0.5 to 20 atmospheres, have been computed with the aid of suitable interpolation relations. The paper referred to may be consulted for the equations and methods used. The results are tabulated below:

Table I—Vapor Composition (y) and Pressure (P) as a Function of Liquid Composition (x) at Various Constant Temperatures
(y and x expressed in mol fractions, P in atm. and T. in °K.).

	T = 75.00		T = 80.00		T = 85.00		T = 90.00	
100 x	100 y	P	100 y	P	100 y	P	100 y	P
0	0	0.757	0	1.349	0	2.242	0	3.535
10.00	2.65	0.700	2.97	1.255	3.35	2.101	3.76	3.323
20.00	5.52	0.646	6.21	1.161	7.01	1.947	7.84	3.083
30.00	8.70	0.591	9.83	1.064	11.08	1.789	12.36	2.840
40.00	12.34	0.533	14.00	0.964	15.75	1.627	17.51	2.592
50.00	16.67	0.473	18.93	0.862	21.28	1.463	23.52	2.341
60.00	22.07	0.411	25.07	0.755	28.02	1.292	30.79	2.083
70.00	29.30	0.347	33.14	0.661	36.77	1.117	40.02	1.818
80.00	39.95	0.281	44.70	0.533	48.86	0.937	52.35	1.547
90.00	58.35	0.215	63.25	0.418	67.30	0.752	70.40	1.266
95.00	74.00	0.180	77.95	0.363	81.00	0.664	83.10	1.132
100.00	100.00	0.145	100.00	0.302	100.00	0.569	100.00	0.991

	T = 95.00		T = 100.00		T = 105.00		T = 110.00	
100 x	100 y	P	100 y	P	100 y	P	100 y	P
0	0	5.309	0	7.666	0	10.708	0	14.54
10.00	4.17	5.007	4.59	7.243	5.08	10.11	5.59	13.70
20.00	8.68	4.652	9.51	6.734	10.45	9.412	11.43	12.76
30.00	13.65	4.293	14.90	6.227	16.25	8.716	17.65	11.83
40.00	19.24	3.931	20.89	5.717	22.62	8.024	24.38	10.92
50.00	25.68	3.565	27.72	5.207	29.80	7.335	31.84	10.02
60.00	33.40	3.193	35.75	4.690	38.10	6.642	40.33	9.114
70.00	42.95	2.813	45.55	4.165	48.03	5.940	50.30	8.204
80.00	55.50	2.423	57.83	3.628	60.45	5.229	62.60	7.288
90.00	72.95	2.020	75.00	3.074	76.80	4.495	78.35	6.350
95.00	84.85	1.807	86.15	2.781	87.30	4.106	88.20	5.860
100.00	100.00	1.608	100.00	2.508	100.00	3.748	100.00	5.396

	T = 115.00		T = 120.00		T = 125.00			
100 x	100 y	P	100 y	P	100 y	P		
0	0	19.28	0	25.04	0	31.94	.....	.....
10.00	6.14	18.08	6.71	23.30	7.62	28.44	.....	.....
20.00	12.45	16.85	13.47	21.74	14.95	27.48	.....	.....
30.00	19.08	15.65	20.44	20.21	22.26	25.58	.....	.....
40.00	26.20	14.47	27.80	18.73	29.80	23.75	.....	.....
50.00	33.98	13.31	35.78	17.28	37.80	21.96	.....	.....
60.00	42.70	12.17	44.64	15.85	46.65	20.22	.....	.....
70.00	52.83	11.02	54.80	14.43	56.70	18.51	.....	.....
80.00	64.90	9.870	66.80	13.03	68.55	16.83	.....	.....
90.00	80.10	8.706	81.50	11.63	82.70	15.17	.....	.....
95.00	89.30	8.100	90.05	10.94	90.90	14.38	.....	.....
100.00	100.00	7.523	100.00	10.20	100.00	13.47	.....	.....

A function "*a*" which is defined as $\frac{y(1-x)}{x(1-y)}$ was found to be very nearly a constant along each isobar and this gives a useful equation for calculations where great accuracy is not necessary. The recommended values of "*a*" for each pressure are as follows:

P	a
0.5	0.2027
1.0	0.2478
5.0	0.3798
10.0	0.4681
15.0	0.5292
20.0	0.5750

By plotting "*a*" as a function of *P*, then *y* could easily be calculated for any *p* and any *x* from the relation

$$y = \frac{ax}{1-x+ax}.$$

Table II—Vapor Composition and Temperature as a Function of Liquid Composition at Various Constant Pressures

	P = 0.5000 Atm.		P = 1.000 Atm.		P = 5.000 Atm.		P = 10.000 Atm.		P = 15.000 Atm.		P = 20.000 Atm.		
100 x	100 y	T°K	100 y	T°K	100 y	T°K	100 y	T°K	100 y	T°K	100 y	T°K	100 x
0	0	71.91	0	77.35	0	94.23	0	103.94	0	110.53	0	115.67	0
10	2.49	72.40	2.83	77.98	4.17	94.98	5.06	104.82	5.76	111.59	6.00	116.94	10
20	5.24	73.00	6.01	78.66	8.81	95.94	10.64	105.96	12.00	112.85	12.55	118.32	20
30	8.42	73.70	9.69	79.44	14.15	96.99	16.85	107.19	18.85	114.22	19.72	119.79	30
40	12.16	74.50	14.09	80.33	20.30	98.15	23.83	108.52	26.42	115.67	27.70	121.34	40
50	16.87	75.44	19.54	81.35	27.50	99.44	31.83	109.97	34.86	117.24	36.50	123.00	50
60	22.95	76.55	26.50	82.54	36.15	100.88	41.00	111.56	44.27	118.92	46.30	124.76	60
70	31.50	77.87	35.95	83.94	46.81	102.51	51.95	113.31	55.00	120.75	57.25	126.64	70
80	44.15	79.47	49.19	85.62	60.15	104.36	64.95	115.23	67.60	122.70	69.70	128.62	80
90	64.55	81.47	69.00	87.67	77.25	106.49	80.85	117.34	82.55	124.78	83.80	130.66	90
95	80.20	82.71	82.65	88.91	87.75	107.68	89.90	118.45	.....	125.81	.....	.....	95
100	100.00	84.01	100.00	90.17	100.00	108.93	100.00	119.67	100.00	127.04	100.00	132.86	100

New England's Only Cement Mill

By C. H. Sonntag

Consulting Engineer, Lawrence Portland Cement Company, Thomaston, Maine

THIS year marked the completion of the only portland cement plant in New England. Construction began when ground for the office building was broken May 12, 1927, and the first kiln was fired April 13, 1928, establishing a record for construction time considering that work had to be carried on through a severe Maine winter. The new mill is located between the towns of Thomaston and Rockland and is owned by the Lawrence Portland Cement Company, which has its principal offices in New York City and operates an older mill at Northampton, Penna. A plant to be built in Maine and designed with due consideration for the length and severity of the winters and the comparative shortness of the shipping season must necessarily embody features not required in mills located farther south.

The company owns about 900 acres of land, of which the larger part is a single parcel including the mill location and the stone and clay deposits (see Fig. 1). Property along the waterfront in Rockland is also owned, as is the right to build a railroad from the plant to waterside. The company is hence in position to organize water shipment on a large scale whenever it may seem desirable.

Coal and gypsum are received by water but since water transportation in winter is rather uncertain, arrangements have been provided for storing enough of these to operate the plant four months at capacity. These storages will be filled during late summer and autumn, and depleted during the winter. Coal is used only in the kilns, since power is purchased. West Virginia gas slack comes to Rockland by water from Atlantic ports of the coal railroads. The cement company transfers it from barges to cars, which are hauled about three miles to the mill. All cement makers add about 3½ per cent of raw gypsum to their product to regulate the set. The gypsum used in this mill is received by barge in sizes ranging from 3-in. lumps to dust and is hauled in the same way as the coal. It is crushed to about ¾ in. size before use.

There are a number of local sources for the other raw materials. The Rockland-Thomaston area has been the seat of an extensive lime-burning industry for nearly 200 years. While there is much stone that is not suitable for lime-burning, practically all can be used as raw material for cement, and in the quarry that the cement company has now opened, it is possible to make a suitable raw mix by careful selection of the stone, without adding clay from another source. In general, however, a small amount of clay is needed.

There are two sources of clay to be used with the limestone. One is a layer of glacial detritus from 4 to 12 ft. thick which overlies the limestone. It varies in its nature from clean gravel and sand to a fine grained clay, and this latter is of the correct composition for use in making cement. Since it must be removed as stripping in order to recover the stone, it is good economics to use as much of it as is needed in the manufacturing process. The other supply of clay is derived from ancient fillings in the valleys of small streams tributary to Penobscot Bay. These valleys are filled with a homogenous, very fine-grained deposit of marine clay, which has been found to be ideally adapted to the manufacture of a high grade portland cement.

Quarrying and Crushing—The quarry is operated in the same way as many other limestone quarries in the country, but as it contains both high- and low-lime rock, separated by a sharp line of division, a certain amount of selection is necessary in order to maintain a correct mix. However, all of the stone is used.

The blasted stone is loaded into cars by an electric shovel, and moved to the foot of the incline by gasoline locomotives. The cars are pulled up the incline by an Allis-Chalmers balanced hoist, since hoisting in balance saves about 30 per cent in power (see Fig. 3). The primary crusher is an Allis-Chalmers gyratory with a 42 in. opening. The stone then passes to a Williams all-steel hammer mill, where it is reduced to about 1½ in. size. Belt conveyors distribute it into storage by means of a traveling tripper. The action is somewhat similar to the ore-bedding conveyors used at certain smelters, and irregularities in the quality of the rock are considerably smoothed out. Further distribution in storage is by means of an overhead electric traveling crane of 100 ft. span, carrying a 3 cu.yd. bucket. The same crane serves the gypsum and clinker storages.

For the present the marine clay previously mentioned is being used. It is dug from the swamp by a gasoline drag-line crane and loaded into side dump cars. A gasoline locomotive moves them about 3,000 ft. to the clay storage where they are dumped. The clay is distributed by an overhead crane of 60 ft. span carrying a 3 cu.yd. bucket. This same crane delivers clay to the hopper of a granulator, from which it passes through a pair of stone separating rolls into a 26 ft. wash mill. Here it is made into a suspension in water and is pumped by a Wilfley centrifugal pump into the storage basin in the mill room. Settling in this basin is prevented by agitation.

Raw Grinding is accomplished in two Compeb mills fitted with external screens between the ball mill and tube mill compartments. These have table feeders to handle the crushed rock, and the clay is added by ferris wheel feeders driven by small variable speed direct-current motors, and additional water is also introduced into the mills so that the product is a slurry containing about 33 per cent of water.

Absolute chemical control of the mixing of stone and clay at this point is essential. In addition to varying the speed of the feeder motors the amount of clay handled can be further controlled by putting on or taking off buckets from the wheels of the feeders. In this way compensation can be made for any extreme variation in the analysis of the rock. The clay itself is very uniform.

Both Compeb mills discharge into a single trough in which a ribbon agitator prevents settling. Wilfley pumps send the slurry to the correction tanks in the kiln building. There are 12 of these tanks, each 16 ft. in diameter and 26 ft. high, and intended to hold 24 ft. of slurry. Each is fitted with an agitator of the screw propeller type and with compressed air pipes for emergency use. Two of the tanks are reserved, one for a slurry made of limestone and another for a clay slurry only, these being for use in correcting the composition of the slurry as it comes from the mills. Three Wilfley pumps and an elaborate system of piping permit the contents of any tank to be transferred to any other tank, and in this way slurries containing various percentages of lime can be

Fig. 2—The Rotary Kilns Used at this Plant are 200 Ft. Long and 11 Ft. in Diameter

mixed so that the resultant is of the correct composition before it leaves the control of the chemist. When a tank has been thoroughly agitated so that its contents are uniform, and has been analyzed and found to be of correct composition, its contents are pumped to an oval storage basin under the kilns. An agitator prevents settling. This correcting and blending system has met every expectation, since it is possible by means of it to feed the kilns with a slurry of a calcium-carbonate content that does not vary more than two or three tenths of one per cent from that determined in advance.

Burning—There are two Allis-Chalmers kilns, 11 ft. in diameter and 200 ft. long, and each is driven by a variable speed motor. They have a slope of $\frac{3}{8}$ in. per foot, and each has a chimney 11 ft. in diameter and 235 ft. high, built by the Rust Engineering Company. Each kiln discharges into a rotary cooler 10 ft. in diameter and 90 ft. long, these being the largest coolers that have been installed for use in connection with kilns of this size. They have a slope of $\frac{3}{4}$ in. per ft., and discharge onto a Bethlehem drag chain conveyor which delivers the clinker to storage or to grinding machinery.

The kilns are fed from the storage basin by ferris wheel feeders, from which the overflow returns to the basins. The feeders do not have independent motors,

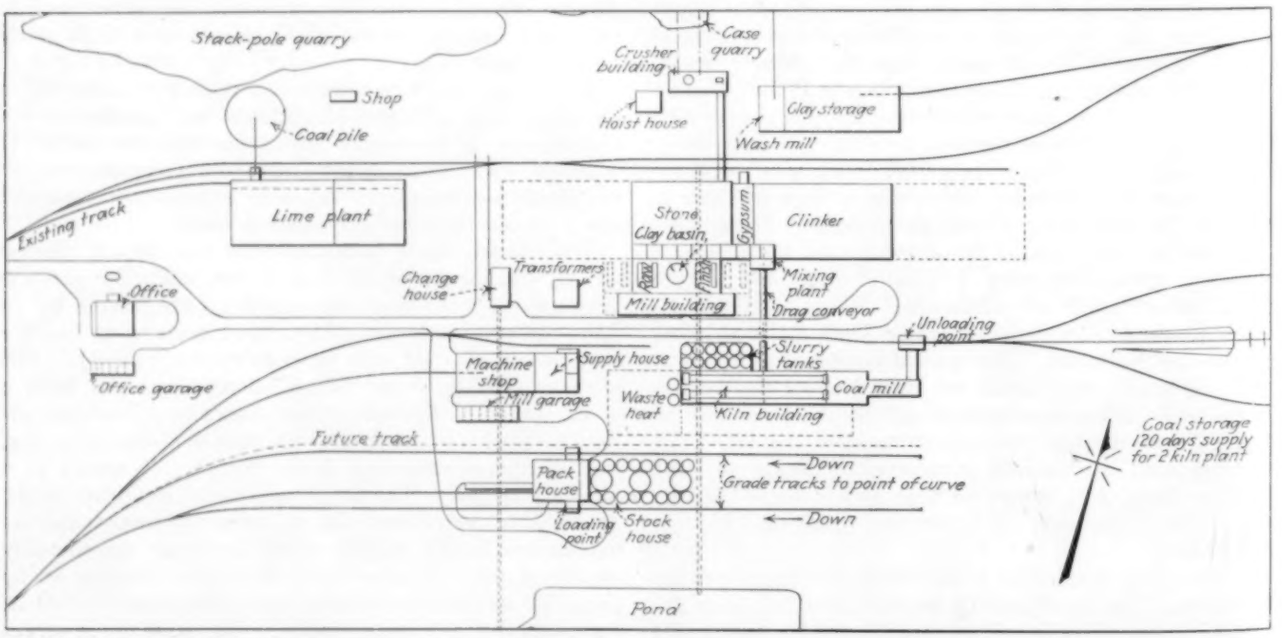


Fig. 1—General Plant Layout of the Lawrence Portland Cement Company at Thomaston, Maine

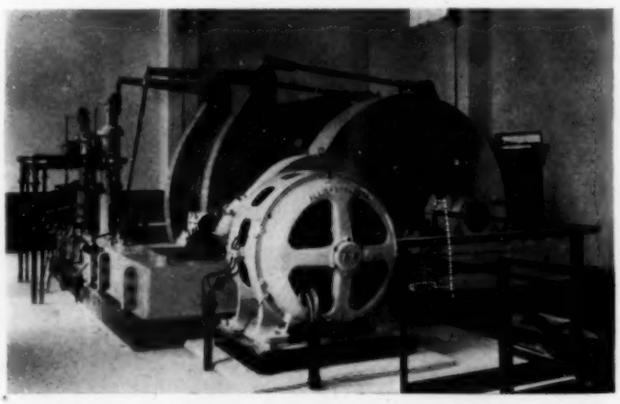


Fig. 3—The Hoist Used for the Quarry Cars has a 9-Ft. Drum and is Driven by a 20-H.p. Motor

but are driven from an extension of the kiln driving mechanism by means of a single wrap of wire rope. It follows that the speed of the feeder is always proportional to that of the kiln to which it is connected, and in consequence it is not possible to have a kiln overloaded for an hour or so, and then directly afterward have it fed too lightly. It is not believed by the engineers in charge of design that the kiln operator should have any independent control of the feed.

The shipping season in New England is comparatively short, since Northern contractors have not yet learned that concrete construction can be carried on in the severest weather if correct methods are used. To keep the clinker-grinding machinery in operation all winter would involve an abnormally large storage for cement, which would be filled and emptied only once a year, and the cost of grinding would be incurred a considerable time before it could be reimbursed by the sale of cement. It is manifestly cheaper to store the product of the kilns in the half-finished form of clinker and to grind this more nearly as it is needed to supply the trade. To meet this condition a covered storage that will hold all the clinker produced by operation for three months has been built as a continuation of the limestone storage.

Coal Preparation—The coal, usually slack or screenings, passes through a Pennsylvania crusher to break up stray lumps, and is fed to a Ruggles-Coles drier by a Schaffer poidometer, which registers the weight of coal handled. The drier furnace is fired by powdered coal. Grinding is done in two 5-roll Raymond mills with air separation and automatic feed control. The fine coal is delivered directly to the bins in the kiln room without any pump or other apparatus except a short conveyor.

The powdered coal feeder for the coal drier furnace is of the 3-in. screw type, the coal being blown 125 ft. through a 4-in. pipe. For each kiln there is a Bailey feeder rated at 8,000 lb. per hour. All these feeders are driven by variable speed direct-current motors, Sturtevant blowers supplying air for combustion.

Clinker Grinding—The mixing plant consists of two Schaffer poidometers, mutually inter-connected and so speeded as to mix about 3½ per cent of gypsum with the clinker, at the same time registering the weights handled, and so serving as production meters. The mixture goes on two Compeb mills, which are almost exact duplicates of the raw mills except for the changes necessitated by grinding dry instead of wet. Their product, which is portland cement, is pumped through a 5-in. pipe line about 600 ft. long by one of two 8-in. Fuller-Kinyon pumps.

There was a definite reason for selecting the particular type of mill that was used. The feeders are of the revolving table design. This was selected in preference to the swinging gate because it is simple, so open that the feed is at all times in sight, and has no reciprocating parts, which usually wear rapidly. A mill that has an external screen between the ball and tube mill sections was specified. The reason is that with some of the earlier Compeb mills, which had only grid partitions between the compartments, material sometimes passed from the ball to the tube mill section before it was fine enough for the latter to finish it. The result was the presence of a few quite coarse particles in the finished product. In the mill with external screen the product of the ball mill must pass through the screen before it can enter the tube mill. The maximum size of the particles that can enter the latter is then definitely determined, and by proper selection of the mesh of the screen, assurance that material going to the tube mill will be properly finished may be had, and the relative proportions of the work done by the ball and tube mill sections can be fixed and altered only when found necessary or desirable.

Power Supply and Generation—About one-third of the cement mills in this country generate their own power from the heat in the stack gases of their kilns. In the present instance the Central Maine Power Company offered energy at a rate that made waste-heat power unattractive, and accordingly all energy for the plant is purchased. The substation on the premises consists of three 2,500 kva. transformers, 33,000/2,300 volts. The load is a desirable one for the power company, as it is on for the entire 24 hours, and the use of large synchronous motors keeps the power factor above 90 per cent.

Practically every machine has its individual motor drive. Each Compeb mill has an 800 hp. synchronous motor, and the others range in size down to the small ones driving the sewing machines in the bag repairing department. Motors above 50 hp. run on 2,200 volt current, those of 50 hp. or less are 440 volt machines. All are of Allis-Chalmers make. Slow speed machines, such as elevators and conveyors, are driven through Philadelphia worm gear speed reducers. Two 1,800 c.f.m. Sullivan angle-compound air compressors driven

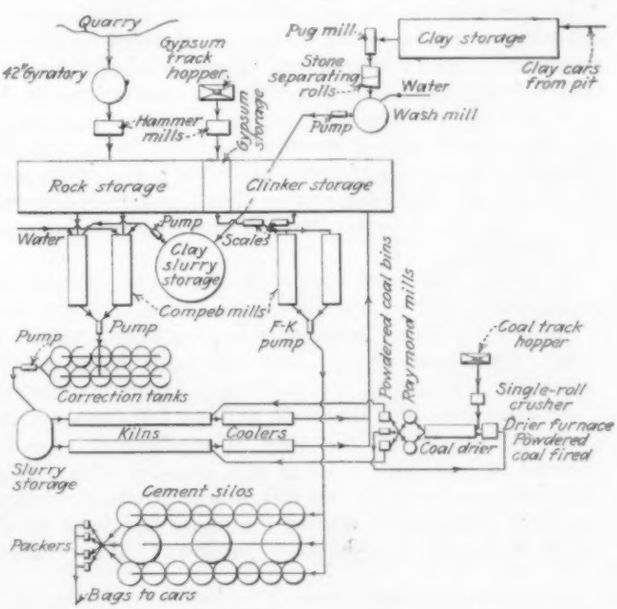


Fig. 4—Mill Flow Sheet for the Thomaston Plant

by 300 hp. synchronous motors supply air for quarrying, for the Fuller-Kinyon pumps and other purposes. A 360 hp. Fairbanks Morse Diesel engine-generator set serves as an emergency source of power to keep the slurry agitators going and to turn the kilns over in case of failure of the purchased power.

Dust Collection—A special dust collector system draws air through the mills, both to reduce the internal temperature and to prevent the emission of dust. In fact each department or machine that can act as a source of dust is furnished with a dust collector, all of which were made by the Northern Blower Company. The result is a plant that can be inspected without soiling good clothes, and this applies even to the coal mill, which was once regarded the dirtiest and most dangerous place in a cement plant.

Provision for the welfare of the workers has been made by the erection of a wash and change house, similar to those installed by coal mines. Plenty of shower baths and other facilities make working conditions far above the average of those found in most cement mills. An exceptionally well-equipped machine shop has been provided, capable of making all ordinary repairs, since there are no commercial repair facilities within a hundred miles of the mill.

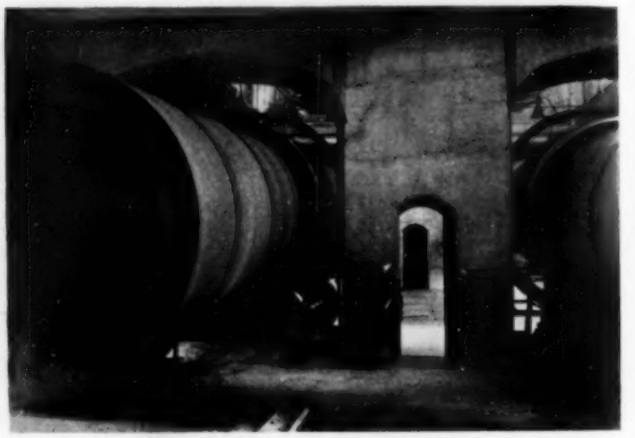


Fig. 5—Rotary Coolers 10 Ft. in Diameter and 90 Ft. Long are Used in This New England Cement Mill

Organized Safety Work Pays in the Cement Industry

By E. Posselt

Vice-President, International Cement Corporation, New York

CEMENT company executives have a very definite obligation to conserve and develop human equipment, which after all is the great motivating force. But, this is not only a moral obligation; it is good business—it gives big returns. A good plant, from a purely mechanical point of view, can be built in a comparatively short time. An efficient operating organization, however, requires much longer time to build and the most exacting efforts on the part of the executives in training the men. A broken bolt can be replaced without a great deal of difficulty; a broken arm cannot be restored to normal function except by the natural process of healing which takes a long time. It is true that if a man is injured, he may be replaced, but the training required to make a substitute proficient is usually no small item, and the change involves loss of time, hard work, and risk; with the result that the substitute, with all of our investment in him, may be no better than the man we had originally in our employ.

In many other ways as well, accidents destroy the effectiveness and morale of organizations. If one man is injured, the entire force may fear or take a dislike to certain equipment, or may even lose faith in the organization for which they are working. Frequent accidents often drive men to other work, and not infrequently very good men are lost in this way. Consequently, it is not unusual to find high accident rate coupled with a large turn-over, and in such cases it is difficult to decide whether the large turnover is due to the many accidents or the many accidents to the large turnover. Nevertheless, these two undesirable factors are closely linked together. In our own industry we notice that last year 347 out of 1,143 accidents were to men employed less than six months, and 486 out of 1,143 accidents occurred to men who had been employed less than one year.

Let us see what the industry has accomplished during the last few years: In January, 1925, lost time accidents were being suffered at the rate of 28 per 1,000,000 bbl. of cement produced. In July, 1928, this rate had dropped to less than 4 accidents per 1,000,000 bbl.

During 1925 lost time accidents averaged 212 per month. By 1927 this rate had dropped to 114 per month. For the first eight months of 1928, they have averaged 88 per month.

The accident total for the last three months has only been equal to the total for one average month two years ago. The quarter ending on June 30, which is the last one for which figures are available, shows 10 per cent fewer accidents than any previous quarter and the half year ending on the same date shows 15 per cent reduction over any previous similar annual period. Most assuredly these results are worth while.

Improvement in the plants and equipment has no doubt been a factor in this performance, but without the organized effort of our entire industry through the Portland Cement Association Accident Prevention Bureau, and the individual efforts in every plant, I am sure we would have had another picture to present.

A QUESTION that many of us are inclined to ask is "Does this work pay dividends?" Does anything which reduces the interruptions in our operations, which cuts down the clerical work, which minimizes labor turnover, which saves medical expenses, and which builds up the morale of an entire organization have any cash value? The answer to these questions is, of course, that it does. We, in the cement industry, are convinced that it does from the results in our own plants. However, this answer was further confirmed in an investigation of accidents and production, by the American Engineering Council. A report on such an investigation was presented before the meeting of the American Society of Mechanical Engineers at the Spring meeting at White Sulphur Springs in May, 1927. The findings of this investigation were based on information from about 14,000 companies and show conclusively a distinct relation between accident prevention and increased production.

Extracts from a paper presented before the Cement Section of the National Safety Council at the Seventeenth Annual Safety Congress in New York City, October 2, 1928.

CHEMICAL ENGINEER'S BOOKSHELF

Perspective of Nitrogen Fixation

FIXATION OF ATMOSPHERIC NITROGEN. By *Frank A. Ernst.* D. Van Nostrand Company, New York. 154 pages. Price, $2.

Reviewed by CHAPLIN TYLER

In Chaper I Mr. Ernst introduces his subject with a brief discussion of nitrogen sources including organic nitrogen materials, natural nitrates, deposits of coal and peat, and the atmosphere. The conclusion is that the atmosphere is the only adequate and dependable source of supply of nitrogen. Chapter II contains the history of nitrogen compounds and of the various fixation processes. It is notable that the composition of ammonia has been known only 150 years, and that the entire history of commercial nitrogen fixation has occurred within the past quarter century. In Chapters III, IV, and V the arc process, cyanamide process, and the direct synthesis ammonia process are discussed. Raw material and energy requirements are presented numerically, thus supplementing the general process descriptions. Chapter VI deals with some of the more important economic considerations of the three principal fixation processes. Capital costs, raw material and energy requirements are compared. In Chapter VII the processes of manufacture of the principal ammonia conversion products are discussed, including ammonium sulphate, ammonium phosphate, ammonium nitrate, nitric acid, and urea. The book concludes with a chapter on the statistics of nitrogen fixation, with particular reference to the United States. There are useful appendixes on the cost of Chile nitrate, and on the location of commercial plants for the fixation of nitrogen by the arc, cyanamide, and direct synthetic ammonia processes.

The book is well written, and should be of interest to those seeking an introduction to the important subject of nitrogen fixation. The following minor errors were noted: On p. 11 "Priestley" is misspelled; also on p. 11 "Bertelot" is cited incorrectly for work done by Berthollet; on p. 14 "la Grande" is misspelled; on p. 82 the word "flop" is used instead of "flow"; and on p. 112 the cost of nitric acid through Chile nitrate should be $95.90 instead of $63.90.

* * * *

Cements, Limes and Plasters

CEMENTS, LIMES AND PLASTERS. Their Materials, Manufacture and Properties. By *Edwin C. Eckel.* 3rd edition. John Wiley and Sons, Inc., New York. 1928. 699 pages. Price, $7.

Reviewed by H. A. NEVILLE

Since this is the most valuable and complete reference work in its field, it seems unfortunate that the author has not deemed it necessary to revise and bring up to date the body of his book, although he has added in this edition a new section dealing with types of cements which have come into general use since the second edition was published (1922). This new feature treats of cements devised to resist climatic and chemical attack and those which develop high early strength for use in rapid construction—respectively, the alumina cements and the accelerated or high-strength portlands.

The book is notably clear in its definitions and classifications of cementing materials. Considerable attention is given to equipment, plant lay-out, and the economics of the processes. The cost data given here is, of course, largely obsolete. Numerous references to the literature of the subject are appended to most sections. These references are far from complete, the most recent work being ignored in most cases.

It is probably not to be expected that a practical reference work of this type should give much attention to the theory or mechanism of the processes involved. However, some mention of the trend of ideas might well be given. The reviewer was unable to find any reference in this book to the now generally accepted view of the colloidal nature of the materials and processes involved in the setting of plasters and cements. The explanation here given for the setting of plaster of paris and for its acceleration has been discredited by recent experimental evidence.

* * * *

Physical Chemistry

THEORETICAL AND EXPERIMENTAL PHYSICAL CHEMISTRY. By *J. C. Crocker* and *Frank Matthews.* The Macmillan Company, New York, 1928. VIII + 581 pages.

Reviewed by E. B. MILLARD

The authors have stated that their purpose in preparing the present volume is to aid students in their honours degree examinations, and that they have endeavored to include in a single volume material which students usually derive from several sources. The descriptive material is divided into nine sections: gases, spectrometry, constitution and physical properties, chemical energetics, heterogeneous equilibrium, solutions and disperse systems, electrochemistry, chemical kinetics and reactivity, theory of the atom. In addition to the material ordinarily included in a text book they have given outlines of laboratory procedure and examples of the calculations involved.

The method of treatment is the conventional one almost to a fault. It is believed that students will find densities referred to oxygen as sixteen very confusing, since the molecular weight is then twice the relative density. Gaseous dissociation is still described as an anomaly rather than as a chemical system undergoing reaction. The chapter on the application of X-rays seems to be not clearly written. There is no mention of a "unit cube" and it is surprising to see mention made of the "molecule" of sodium chloride. The chapter on conductivity mentions the constancy of a solubility product as a consequence of the law of mass action applying to the ionization of a salt. There is no mention of the growing belief that the conductance ratio is not wholly satisfactory as a measure of ionization. The law of mass action "is true only for small ranges of dilution in the case of strong electrolytes" but no useful purpose is served by discussing these "anomalies." The only indication that any progress along these lines has been made since 1907 or is desired at the present time occurs in six lines stating that Debye and Hückel have reached

Sutherland's conclusion that ionization is complete. The activity is a "fictitious quantity" devised by Lewis and when this is introduced into thermodynamic equations "the laws are assumed to be strictly satisfied." No mention of this fictitious quantity occurs in the chapter on electromotive force. The subject of indicators is treated in a single paragraph in which no mention is made of hydrogen ion concentration.

The objections raised to the treatment in this text are, to a certain extent, matters of opinion on which the reviewer differs with the authors. Nevertheless, it is unfortunate that a new book should fail to indicate the many changes which are now going on in physical chemistry. There is no doubt that many of the views expressed in this book (or in any other) will need revision from time to time; and in presenting material the reviewer believes that an open mind should be cultivated in the student. This point of view is stated clearly in the preface of the present book. "The fascination of physical chemistry is in a great measure due to the fact that a large part of the field is still unexplored, and the worker very frequently breaks new ground." It is in failing to emphasize an unmistakable disturbance of the ground that this book falls short of one's expectations.

* * * *

Two Aids to Experiment

A Laboratory Manual of Elementary Physical Chemistry. By *Edward Mack, Jr.* and *Wesley G. France.* D. Van Nostrand Company, New York, 1928. 195 pages. Price, $2.

Reviewed by John E. Vance

This useful manual has been designed by the authors to give adequate experience in the various types of experimental measurements without over-emphasizing one particular sort: a fault they point out in the usual elementary course, which tends to devote an undue amount of time to the determination of molecular weights and to the study of the properties of solutions.

Thirty-five experiments, in all, are presented. They include those customarily given in intermediate courses as well as those of a more elementary nature. A new experiment on photochemistry and several physics experiments are in the book, dealing with thermionic tubes, the ratio of the specific heats of gases, the thermal conductivity of gases and the dielectric constants of liquids. These should not conflict with an elementary physics course and should give some worth while experience. Each experiment is carefully described, the apparatus explained and the calculations clearly indicated. The actual theory is in most cases left to the many references throughout the book to texts and to published papers.

The work has been nicely done and the book itself has a pleasing appearance, being uniform with Professor Hugh S. Taylor's text on elementary physical chemistry, to which it is intended to be a laboratory supplement.

Elementary Practical Physical Chemistry. By *Frank Sherwood Taylor,* Oxford University Press, American Branch, N. Y. 1928. 130 pages. Price, $1.25.

Making no pretense of obtaining other than qualitative results, the experiments set forth in this book cover all the more familiar phenomena and methods of measurement. No apparatus more complicated than that usually found in elementary laboratories or that can be easily pieced together is required. A physical course planned along these lines, while rare in American schools, should be worthy of trial, especially since it would display the principles to those not continuing a study of physical chemistry.

* * * *

Alpha Particles and Electrons

The Chemical Effects of Alpha Particles and Electrons. Second Edition (Revised and Enlarged). By *S. C. Lind.* The Chemical Catalog Company, New York. 260 pages. Price, $5.

Reviewed by D. C. Bardwell

In the second edition the author has again demonstrated his ability to present this subject so clearly and completely that one need not resort to outside references. However, the references are given and make up a very complete bibliography. Since the appearance of the first edition, a large number of chemical reactions produced by ionization have been studied quantitatively by the author and his co-workers and by Prof. W. Mund and his co-workers. The development of a general equation for the evaluation of gaseous ionization by radon in spheres has been of great value in supplementing the average path method developed by the author.

The earlier work from which it was possible to compare the quantity of chemical reaction with the amount of ionization was interpreted in the first edition by a theory of ionic clustering. The newer work has in general strengthened this theory. Although prediction of the effective ion clusters for new gas systems still remains a problem to be solved, it is possible to classify those systems which have been studied as to the number of molecules which will react per ion pair.

The catalytic property of inert ions is of particular interest and is discussed with reference to those properties which agree and those which conflict with physical measurements. The recent work which brings out certain parallelisms between the mechanisms of the photosynthesis of hydrogen chloride and its synthesis by ionization brings these fields closer together. The chapters on the coloring of precious stones by radium radiations would be read with much interest by the layman as well as the chemist.

* * * *

Calorimetry

The Modern Calorimeter. By *Walter P. White.* Chemical Catalog Company, New York, 1928. 194 pages. Price $4.

Reviewed by Donald H. Andrews

An elemental calorimeter may be adequately described as a can of water, a thermometer and a stirrer. The varied forms of apparatus into which this simple device has evolved, together with the general problems of heat measurement they all have in common, constitute the subject matter of Dr. White's monograph. First there is a brief chapter outlining calorimetry and its methods, which is recommended as an excellent summary of the subject for those with only a general interest in it. This is followed by a chapter of 86 pages on "The Fundamental Processes and Measurements," which is a clear exposition of the problems involved and the best methods for solving them with varying degrees of precision; it includes under each heading a large though well ordered amount of detail which should be useful to any one confronted with a practical application of the principles of heat measurement either in laboratory or plant. Finally

particular types of water calorimeters and related instruments are discussed, likewise in great detail. A careful study of these chapters should give any one working with calorimeters valuable suggestions for securing greater accuracy and speed. It is regrettable that so well written a book could not have been extended to cover other branches of calorimetry such as measurements at low temperatures.

* * * *

Solubilities of Compounds

SOLUBILITIES OF INORGANIC AND ORGANIC COMPOUNDS, Volume II. By *Atherton Seidell.* D. Van Nostrand Company, New York. 1928. 573 pages. Price, $8.

Reviewed by F. W. SMITHER

Supplementing the second edition, this volume contains the data published in the literature during the years 1917 to 1926 inclusive. "The collection and arrangement of the data contained in the present supplement have been made in exactly the same manner as described in the Preface and chapter on General Information of the second edition." The author has, so far as possible, recorded the original experimental values, accompanying the tables with descriptive matter covering, so far as reported, source and purity of materials and the procedures followed. As stated by a reviewer of the second edition "the author is to be commended for emphasizing the identity of solubility and freezing-point data, a fact known to all but not universally appreciated." Many references and tables relative to freezing points of mixtures are included.

The book seems to have been carefully compiled and certain errors in previous editions have been corrected. However, in a book of this kind the opportunities for errors are innumerable and the author frankly states in the preface that "the limitations in accuracy and completeness of the work as there described (in the second edition) apply in equal measure to this supplementary volume."

A subject index common to both the second edition and the present supplement is provided at the end of the latter. The book should prove as useful to chemists and chemical engineers as the previous editions.

* * * *

Technical Chemical Analysis

TECHNICAL METHODS OF CHEMICAL ANALYSIS, II. *G. Lunge* and *C. A. Keane.* 2nd Edition. Edited by *C. A. Keane* and *P. C. L. Thorne.* Gurney and Jackson, London. 1928. 644 pages. Price, £3.3s.

That the canonical array of fundamental reference works is not being permitted to become merely venerable is again indicated by the growing new edition of Lunge. In accord with the revised arrangement and matter of the work, the second volume contains industrially related groups of chemicals, the analyses of which are severally allotted to the care of single editors. A particular feature of the new edition is the increased attention given to American and British methods and to the new funds of information such as recent periodicals and the approved atomic weights of 1925.

The new subject grouping was intended to make this book a self-contained volume. It comprises Iron and Steel, Non-Ferrous Metals, both by C. O. Bannister; Metallic Salts, by W. R. Scholler; Potassium Salts, by J. T. Dunn; Paints and Pigments and Paint Vehicles, Japans and Varnishes, both by R. S. Morrell.

CHEMICAL ENGINEERING CATALOG. Thirteenth Annual Edition, 1928. The Chemical Catalog Company, Inc., New York. 1,107 pages. Price, to those technically qualified, $3, or exchange of previous edition; to others, $10.

Containing the well-known material that has made this catalog so generally useful, the new annual edition offers, by way of progress, an improved typographical appearance and a desirable firm binding. The contents embrace a 100-page classified index of equipment and supplies, a 749-page equipment and supplies section, an 84-page classified index of chemicals and raw materials, a 94-page chemicals and raw materials section, and the customary book section. In addition there are two short indexes to manufacturers' and trade names.

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COLLEGE CHEMISTRY. By *Neil E. Gordon.* World Book Company, Yonkers, N. Y. 1928. 516 pages. Price, $2.96.

As a companion volume to the author's "Introductory College Chemistry" this book is intended for the college student who already has an elementary background. The arrangement, in its attempt to be logical, is somewhat questionable, but on this point there has never been any hope of general agreement. It is attractively illustrated and to its chosen group broadly informative.

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Nitrogen and Metal-Ammines

A TEXTBOOK OF INORGANIC CHEMISTRY. Edited by *J. Newton Friend.* In eighteen volumes. Charles Griffin & Company, Ltd., London, and J. B. Lippincott Company, Philadelphia.

Volume VI, Part I. NITROGEN. By *Edmund B. R. Prideaux* and *Herbert Lambourne.* 1928. 242 pages. Price, $10.

Volume X. METAL-AMMINES. By Miss *M. M. J. Sutherland.* 1928. 260 pages. Price, $10.

With eleven volumes in the course of completion and several of the older ones already in new editions, Friend's thorough enterprise is rapidly covering and keeping fresh its chosen territory. The two latest additions to the series are devoted to the inorganic chemistry of nitrogen and the metal-ammines.

Introduced by a general consideration of structure and linkage, the treatise on nitrogen deals principally with the element, the hydrides, the oxides, and the acids. All phases of chemical interest are subjected to the inclusive study that happily characterizes the series. There are also briefer sections on non-metallic compounds and nitrogen fixation; treatment of the new syntheses for nitric acid is absent, presumably because of their very recent development.

The book on metal-ammines falls naturally into the grouping laid down by the periodic system. This separate treatment of the "ammines" seems especially desirable; their spelling suggests their relationship to ammonia and their distinction from the ammonium salts and the substituted compounds, the amines. Since, in addition, most of the previous work had been done on a few metals, this co-ordinating effort constitutes an inviting monograph in itself.

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SCIENTIFIC PURCHASING. By *Edward T. Gushée* and *L. F. Boffey.* McGraw-Hill Book Company, New York. 1928. 196 pages. Price, $3.

Explaining in their foreword how the word "scientific" may be taken to apply to a subject of this nature, the authors treat the various phases of purchasing from this analytical and critical viewpoint. The two parts of

the book contain, respectively, the principles and the methods. In the hands of other department heads, as well as of the purchasing personnel, it should give an excellent insight into the functions of a well-directed purchasing unit.

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CHEMICAL CALCULATIONS. By *J. S. Long* and *H. V. Anderson*. 2nd edition. McGraw-Hill Book Company, New York. 1928. 227 pages. Price, $1.75.

In this second edition the authors have made such changes and revision as the intervening advance of knowledge on certain particular points allowed. Thus the newer findings on electron transfer and atomic structure are incorporated, along with some suggestions arising from the first edition. There are now included problems to the number of 750.

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ELEMENTS OF QUALITATIVE CHEMICAL ANALYSIS. By *W. W. Scott*. D. Van Nostrand Company, New York. 1928. 164 pages. Price, $1.60.

Conveniently and compactly arranged, this book is intended to serve as a guide to the student in learning his fundamental qualitative methods. Courses in general chemistry are presupposed and the standard procedures are attractively presented, with the aid of charts and drawings.

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Society Publications

ANNUAL TABLES OF CONSTANTS AND NUMERICAL DATA, CHEMICAL, PHYSICAL, BIOLOGICAL AND TECHNOLOGICAL. Volume VI, Part II, for 1923-1924. Published under the auspices of the Union of Pure and Applied Chemistry by Gauthier-Villars et Cie., Paris, and McGraw-Hill Book Company, New York. 993 pages.

Monumental in scope, this symposium of tables and data, printed chiefly in French, represents a further milestone on the laborious path undertaken by this body of scientists. The last previous volume appeared in 1927.

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PROCEEDINGS OF THE INSTITUTE OF METALS DIVISION, A.I.M.E., 1928. Published by the Institute, 29 West 39th Street, New York. 836 pages. Price, $6.00.

Continuing the separate proceedings resumed in 1927 by the Institute, this collection includes all the papers presented at the Detroit meeting, Sept. 19-24, 1927, and the New York meeting, Feb. 20-23, 1928. The papers deal with the non-ferrous metals and are further grouped into the secondary and precious metals. By virtue of good press-work and the use of coated paper where necessary, the text and illustrations have an agreeable and serviceable effect on the reader.

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PAPERS AND ADDRESSES (Eleventh Series) presented before and published by the Technical Association of the Pulp and Paper Industry, New York. 1928. 280 pages. Price, $3.

In this official publication of T.A.P.P.I. are to be found all the papers and addresses presented before the various sections during the year. In addition there are a bibliography of paper making and a selection of government patents, both for the year 1927. Since the Association can claim a high prestige in its industry and since many of the present papers are of more than passing importance, it is to be regretted that this volume is not issued in some permanent form, rather than in paper covers.

Patent Grant Ordered for Air Sterilizing Process

FOLLOWING a rejection of two patents involving air sterilization and transference of milk, the District Court for the District of Maryland on October 2 decreed, after the introduction of more specific claims, that a patent on the apparatus and process be issued to the claimant, Schiller *et al*. The insertion of the specific claims had been recommended, since certain features of the operations are not scientifically understood. It was on the basis of these claims that the decree was then issued, although extension of the claims to milk pumping was refused.

In the text of his opinion, Judge Soper summarized the case under controversy: "The complainants have filed a bill of complaint against the Commissioner of Patents, pursuant to the provisions of R. S. Section 4915, complaining that the Commissioner has wrongfully rejected two applications for patents, and praying for a decree directing him to issue patents thereon. The more important of the two applications relates to a method and apparatus for sterilizing and purifying air by killing the bacteria therein. The other application relates to a method and apparatus for transferring milk or other liquids from tank trucks by means of compressed air, which is sterilized before coming in contact with the liquids by the method disclosed in the first mentioned application."

The process involves the compression of air for the transference of milk and the insertion of expansion apparatus, which causes the air to become sterile, meanwhile lowering the temperature from 150 to 70 deg. F. The degree of pressure used is described in the specifications in terms of the resulting temperature. The evidence shows that the air in the compressor is subjected to a pressure of about 3 atmospheres or 45 pounds, and is then expanded through the several tanks until in the receiving tank, the pressure has been reduced to about 2½ atmospheres or about 37 pounds. Since the result achieved is of considerable value and utility, the discovery would seem to rise to the dignity of invention unless it has been anticipated in the prior art.

When the specific claims had been presented it was seen that previous patents had specified expansion at much more elevated temperatures or were not applicable to air, the most nearly related patent (Perkins *et al.*, 640,320) depending upon heat for sterilization. Sterilization at 150—70 deg. was not previously suspected and is not yet explained. Hence the doctrine laid down by the decision is that, to anticipate a process, it is necessary not only to show that the prior patent might have been used to carry out the process, but that such use was contemplated or that it would have occurred to an ordinary worker in operating the device.

Patents, Law and Practice. By Oscar A. Geier. 4th edition. Richards & Geier, 274 Madison Ave., New York. In its new appearance this 46-page book has seen an extensive revision undertaken to incorporate the changes made in official patent practice since 1924. As before, it contains the essential features of patent procedure, freed, however, from their usual legalistic sting. It may be obtained free of charge from the publisher upon request.

Selections from Recent Literature

BISULPHITE LIQUOR. D. W. Stewart. *Pulp and Paper Magazine*, July 26, pp. 1013-6. The Canadian National Research Council has developed a method of utilizing Canadian magnesian rock (magnesite) for making bisulphite liquor for use in pulp manufacture. This makes available to Canadian paper mills a domestic source of supply and at the same time utilizes the advantages of a magnesia sulphite liquor over the usual lime sulphite liquor. The regular tower process is used, with only a little additional equipment. The only change required in the towers is to decrease their number or capacity. Difficulties due to seasonal temperature variations are lessened, and loss of SO_2 is materially reduced. As a final advantage, 40 lb. of calcined magnesite will do the work of 100 lb. of limestone. Several minor advantages, such as elimination of $CaSO_4$ scale in the blow pits, are cited. Patent protection of the new development will be in the name of the National Research Council of Canada.

CATALYSIS. Wolfgang Langenbeck. *Zeitschrift für angewandte Chemie*, July 7, pp. 740-5. A comparison of the acceleration of organic reactions by enzymes with the catalytic effect of organic chemical compounds. The reactions studied include esterification, amidation, hydrolysis of carbohydrates, cyanhydrin formation, decarboxylation, dehydrogenation. Possibilities of extending the present known list of organic catalysts are considered.

VISCOSE HAZARDS. Johann Eggert. *Chemiker-Zeitung*, June 27, pp. 505-6. Removal of toxic gases and vapors given off from viscose machines must be effected at the machines themselves and cannot be tied up with the heating or the humidification system as in other industries. For instance, H_2S (from the spinning machines) is heavy enough to concentrate near the floor; ordinary ventilation merely distributes it through the atmosphere. A system of open channels leading from the machine is recommended, the H_2S being drawn into the channels by fresh air from above. Recommendations are also made for removing H_2S from the spinning bath and the winding machine, and Cl_2 from the bleachery. For corrosion prevention, lead lining may be used for pipe and other parts exposed to H_2S, and Haveg for parts exposed to Cl or hypochlorite. Pumps, pipes and containers may be lined with hard rubber, but Haveg is preferable.

STEAM DRIED COAL. Ludwig A. Richter. *Braunkohle*, Sept. 15, pp. 850-7. Steam dried lignitic coals, of which köflach coal is typical, are superior in several respects to the raw coal and to coals of older geological periods. High reactivity of the coal imparts high thermal value to the gas produced therefrom; the S content is low and the melting point (1,280-1,300 deg. C.) of the ash is high enough to avoid slag formation in coking. This lowers steam consumption and hence gives gas with low water content. The good coking properties of the coal permit operation with high ash bed level, making possible lower gas temperature and avoiding losses in unburned fuel. All the favorable properties taken together permit savings in installation, operating and labor costs for the water gas producers using these dried coals.

ORE TREATMENTS. H. Madel. *Metall und Erz*, Sept. 1, pp. 428-37. Progress of the year 1927 in ore treating methods and equipment is reviewed. Critical discussion is given of the close circuit system of grinding, and the use of vibrating screens; the Krupp-Gruson and James vibrating screens for classification purposes are compared, and other methods of classification considered. Flotation technology is reviewed, with emphasis on the increased use of flotation reagents and the trend toward alkaline media and single concentrates in preference to acid media and mixed concentrates. Machines used in flotation are described and illustrated. Gold ores are also being successfully concentrated by flotation, particularly where amalgamation or cyaniding meet with difficulties.

WATERPROOFING LARGE STRUCTURES. P. Strothotte. *Teer und Bitumen*, Aug. 20, pp. 413-8; Sept. 10, pp. 449-53. Waterproofing of bridges and other massive stone or concrete structures is practiced to avoid damage by rain, ground waters, smoke, fumes and other influences of weathering. Complete impermeability to water and stability to water and atmospheric influences are fundamental requirements. Special conditions of service may also require resistance to chemical attack, high strength and elasticity (vibration resistance), hardness, ability to withstand heat and cold. The merits and demerits of proofing treatments are discussed under the headings: clay, asphaltic concrete, building paper in asphalt cement, Pb coating, asphalt felt, jute fabric in bitumen, wire net reinforced bitumen, cold worked bitumen. Choice of material according to conditions, and methods of application and testing are discussed, and photographs and diagrams are included.

COKING COAL. Oskar Künle. *Brennstoff-Chemie*, Sept, 15, pp. 295-8. In a study of the effect of rising temperature on yield and composition of coke, Parr's observation of an increase in weight on heating at low temperature was confirmed for a Saxon coal. In trials at 225 deg. C. for varying lengths of time, an increase in oxygen content from 9.93 per cent to 23.86 per cent was observed in 10 hours. The ratio of volatile products to coke yield changes progressively with time.

PURIFYING SEWAGE. A Battige. *Apparatebau*, Sept. 7, pp. 206-9. A critical discussion of methods in use for clarifying sewage and purifying it of harmful organic content, particularly in small scale installations. Faults and defects in treatment are considered, and construction of efficient small scale clarifying units is described. Diagrams are shown.

HEAT BALANCE IN COKING. J. G. de Voogd. *Het Gas*, Sept. 1, pp. 367-72. A three-day test is reported, in which a coke oven was operated with careful attention to quantitative relations and to the thermal conditions. From the data of the test, the input and output of heat are both calculated and set forth in itemized comparative columns. The radiation loss amounted to 101 cal. out of 576. The data and calculations are discussed.

CRACKED GASOLINE. Alfred Karsten. *Chemische Apparatur*, Aug. 10, pp. 174-5. The Blümner process and apparatus for cracking tar or shale oils to form gasoline are described and illustrated. The disadvantages of the direct fired cracking still are enumerated. These difficulties are overcome by Blümner by using a bath of molten Pb as heating medium for the cracking still. Yield varies, according to the kind of crude oil used, up to about 80 per cent.

OIL EXTRACTION. Alfred Karsten. *Chemische Apparatur*, Sept. 10, pp. 195-7. The Simon continuous oil extraction process and apparatus may be applied to oils, fats, oil seeds, and other materials containing fatty matter. The apparatus has long service life and is safe in operation; it requires no extensive stirring equipment and no special pressure machinery; and it can be easily expanded to enlarge capacity. It operates automatically, except for inserting and removing the filled extraction basket. A flow sheet is shown.

SAFE HEAT TRANSMISSION. Albert Sander. *Chemische Fabrik*, August 29, pp. 515-6. To avoid the hazards of direct firing of high pressure autoclaves, without the disadvantages of the high pressure necessary with hot water heat, an oil circulation system (differing from the Merrill system used in America) was adopted. The heating medium was a mineral oil, free from resins and mineral acids, and having a high flash point. Heat was supplied to this oil in a fire-proof room through a heat exchanger by hot water from a high pressure boiler (tested to 400 atm.); the oil was then pumped

around the autoclaves and back to the heat exchanger. Application of this system to a series of two 2,000-liter autoclaves to operate at 40 to 50 atm. and one larger autoclave to operate at 12 to 14 atm. pressure is described and illustrated. By indirect heating with water at 250-300 deg. C. the oil retains its viscosity and heat conductivity much longer than with direct firing.

PARCHMENT PAPER. Robert Fritsch. *Zellstoff und Papier*, September, pp. 585-9. Processes and machinery used in the manufacture of parchment paper are critically discussed, with emphasis on the Fritsch parchment machine and the new technique which it introduced into the parchment making industry. Parchmentizing of special varieties of paper, e.g., cigarette papers and osmotic membranes, is considered. Parchmentizing with $ZnCl_2$ is briefly compared with the acid process.

PUMPING FUSED SALTS. Heinrich Oettinger. *Chemische Fabrik*, Aug. 29, pp. 516-8. To improve both the safety and ease of handling fused alkalies and salts, a portable pump has been devised with which such materials can be safely and conveniently handled. Thus, the long hard hand labor formerly required for chopping out the solidified mass of alkali or salt from a metal drum can now be avoided; the material can be melted and quickly pumped out of the container. The pump and its use are described and illustrated.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Efficiencies of Painters' Respirators Filtering Lead Paint, Benzol, and Vitreous Enamel Sprays, by S. H. Katz, E. G. Meiter, and F. H. Gibson, of the U. S. Bureau of Mines staff. Treasury Department Public Health Bulletin 177. 15 cents.

Barium Carbonate—Report of the United States Tariff Commission to the President of the United States. U. S. Tariff Commission pamphlet. 5 cents.

Report of the United States Tariff Commission to the President of the United States . . . in the Matter of Certain Laminated Products. U. S. Tariff Commission pamphlet. 5 cents.

International Sole Leather Trade and Production in 1927. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 571. 10 cents.

Simplified Practice Recommendations of the Department of Commerce on: Malleable Foundry Refractories, R. 79-28, 10 cents; One-Piece Porcelain Insulators, R. 73, 5 cents; Classification of Iron and Steel Scrap (First Revision), R. 58-28, 10 cents; Coated Abrasive Products, R. 89, in the form sent to the interested industries for approval.

U. S. Government Master Specification for Raw Linseed Oil. Supersedes Circular No. 82 (3d. ed.). Bureau of Standards Circular 361. 5 cents.

U. S. Government Master Specification for Boiled Linseed Oil. Supersedes Circular 330. Bureau of Standards Circular 362. 5 cents.

Recovery of Fine Gold by Amalgamation, by E. S. Leaver. Bureau of Mines Information Circular 6081.

Notes on the Determination of Molybdenum, by H. A. Doerner. Bureau of Mines Information Circular 6079.

Desirable Characteristics of Coke: Chemical, by J. D. Davis. Bureau of Mines Serial 2884.

Review of Fatalities in the California Petroleum Industry During the Calendar Year 1927, by G. B. Shea. Bureau of Mines Serial 2881.

Notable Increase in Fuel Economy Recorded at Petroleum Refineries in 1927, by G. R. Hopkins. Bureau of Mines Serial 2886.

Eighteenth Semi-annual Motor Gasoline Survey, by E. C. Lane, D. B. Taliaferro, Jr., and J. A. Mann. Bureau of Mines Serial 2887.

Supplement to Petroleum Refineries of the United States, January 1, 1928. Bureau of Mines Information Circular 6065-A.

Survey of Cracking Plants, January 1, 1928, by G. R. Hopkins. Bureau of Mines Information Circular 6074.

Recent Developments in the Production of Motor Fuels From Coal, by A. C. Fieldner. Bureau of Mines Circular 6075.

Railroad Fuel Oil Consumption in 1927, by Arthur Huber Redfield. Bureau of Mines Information Circular 6078.

Sources and Distribution of Major Petroleum Products, Atlantic Coast States, 1927, by E. B. Swanson. Bureau of Mines Information Circular 6080.

Mineral production statistics for 1926—Separate pamphlets from Bureau of Mines on: Gold, Silver, Copper, Lead, and Zinc in Utah; and Gold, Silver, Copper, Lead, and Zinc in Nevada. Both by C. N. Gerry. 10 cents each.

Mineral production statistics for 1927—Separate pamphlets from Bureau of Mines on: Silica; Fuller's Earth, by Jefferson Middleton; Fuel Briquets, by F. G. Tryon and J. M. Corse; Carbon Black Produced From Natural Gas, by G. R. Hopkins and H. Backus; Fluorspar and Cryolite, by Hubert W. Davis; and Graphite, by Jefferson Middleton. 5 cents each; preliminary mimeographed statements on: Natural Gas; Petroleum, Petroleum Products, and Natural Gasoline; Clay; Stone; Sand and Gravel; and Gold, Silver, Copper, Lead, and Zinc, in Utah, Washington, Montana, Idaho, and Arizona.

Mineral Resources of the United States in 1927 (Preliminary Summary), by Frank J. Katz and Martha B. Clark. Bureau of Mines pamphlet. 20 cents.

Production statistics from 1927 Census of Manufactures in preliminary mimeographed form for: Sand-Lime Brick, Graphite, Rayon and Allied Products, and Corn Syrup, Corn Oil, and Starch.

Animal and Vegetable Fats and Oils—Production, Consumption, Imports, Exports, and Stocks, by Quarters, Calendar Years 1926 and 1927. Pamphlet issued by Bureau of the Census. 5 cents.

Fertilizers. Mimeographed statistical statement issued by the Bureau of the Census on production of fertilizers during first six months of 1928.

Journal of Research is the name of a new periodical published by the Bureau of Standards at Washington to supersede the two series "Scientific Papers" and "Technologic Papers" heretofore issued. The format will correspond with that used by other scientific papers and the contents will represent a closer association of pure and applied research. The annual subscription price has been set at $2.75.

Miscellaneous Publications

Composition of Tar from Low-Temperature Carbonization of Utah Coal.—I., by R. L. Brown and B. F. Branting. Results of joint investigation of Carnegie Institute of Technology and U. S. Bureau of Mines. Available only by purchase from the Carnegie Institute of Technology, Pittsburgh, Pa., at 15 cents.

Review of General Literature on Industrial Accidents, Factory Management, Hours of Work, Fatigue and Rest Periods, Ventilation, and the like. Prepared by Mildred B. Pressman. Library of National Bureau of Casualty and Surety Underwriters, New York. A 43-page list of publications, grouped and arranged.

An investigation of Checkerbrick for Carburetors of Water-Gas Machines, by C. W. Parmelee, S. E. R. Westman, W. H. Pfeiffer. Engineering Bulletin No. 179, University of Illinois. 50 cents.

Technisches Hilfsbuch der Österreichisch-Alpinen Montangesellschaft. Julius Springer, Vienna. Though not likely, in its German form, to be attractive to American engineers, this handy booklet of data and formulas is suggestive, like the well-known *Hütte*, of the service a similarly well-chosen compilation could fulfill here.

THE PLANT NOTEBOOK
an exchange for OPERATING MEN

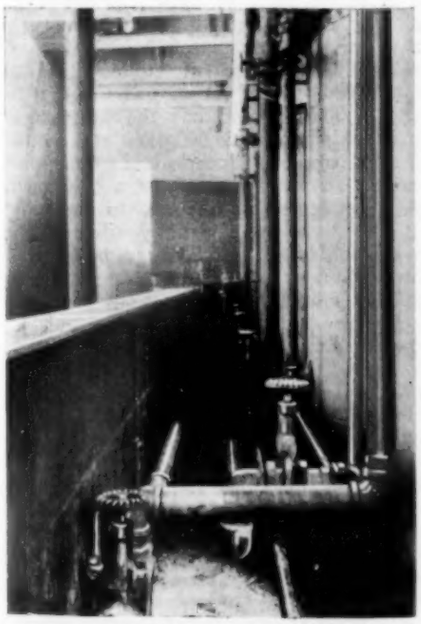
Safe Removal of Caustic Soda from Drums

By H. L. Kauffman
Denver, Colo.

Caustic soda is used in relatively large quantities by petroleum refiners and numerous chemical manufacturing plants. It is usually bought in iron drums weighing from 400 to 450 lb. Because of the injurious effect of cautic lye upon the skin of the worker, and particularly its dangerous effect upon the eyes, great care must be taken by the person opening the drums to prevent any chips of caustic or any caustic dust from getting either upon the skin or into the eyes.

The writer has seen numerous methods in use for opening caustic soda drums: some efficient and designed for the safety of the worker; some inefficient and inconvenient and a constant source of danger to the worker's eyes. In a number of the smaller petroleum refineries a method often used is to cut in the head of the drum with an ax and then either dissolve the material with steam and hot water or attempt to break the caustic into pieces. Unless efficient equipment be provided for handling and dissolving caustic soda, the workman is in constant danger of lye burns.

At the Parco, Wyoming, refinery of Producers and Refiners Corporation, a convenient and efficient method for dissolving caustic soda is in use. At one end of a building housing the towers and lines of the continuous light oil treating plant there was erected a building (made of galvanized sheet iron) for housing five caustic soda dissolving tanks, two small pumps and connecting lines; and also providing ample space for such litharge and caustic soda drums as are needed at ony one time in making up solutions of caustic soda or "doctor." This building is approximately 30 ft. wide by 40 ft. long.



View of Dissolving Tank Piping Laid Inside Concrete Dyke

The main caustic soda dissolving tanks are about 6 ft. in diameter by 6 ft. deep, and have a capacity of approximately 1,300 gal. They rest upon a concrete foundation and are surrounded by a concrete dyke which is about 18 in. in height, and in which are placed all connecting pipe lines. A fifth tank, approximately 6 ft. in diameter and 4 ft. deep, and having a capacity of a little over 900 gal., is used in making up doctor solution, or for any other miscellaneous uses.

Above the center of all tanks is supported firmly in place a steel rail, to which is attached a chain hoist. By this arrangement it is possible for one man to raise and to lower into the dissolving tank a drum of caustic soda (the drum previously having had openings made in it with an ax) without any danger of lye burns to the worker, and with absolutely no waste of caustic soda. The hot water in the tank dissolves out all the caustic from the drum, and while this is taking place the worker is free to go about his other duties. By calculation, and from previous experience, the operator knows how many drums (lb.) of caustic dissolved in a definite number of gallons of water will give a caustic soda solution of the strength desired, and so he definitely controls the amount of water that he places in each tank.

Each of the larger tanks is provided with lines for air, steam and water, and a pumping-out line.

A wooden track is placed around the concrete dyke, so that the iron caustic drums can be rolled about more easily—thus facilitating their handling.

The advantages of a lay-out for dissolving caustic soda as described herein may be briefly summarized as follows:

1—The equipment is relatively inexpensive.
2—It is convenient for the workman.
3—It is efficient; especially in that there is no loss of caustic.
4—It gives to that particular part of the plant a neat-looking appearance rather than the usual sloppy appearance that is so prevalent in many plant departments where caustic soda is used.
5—It gives the greatest possible assurance to the workman that he is not constantly in danger of caustic burns when making up a caustic soda solution (or, in the case of the petroleum refiner, a "doctor" solution also); and an equally great assurance to the employer that he himself is doing all that he possibly can for the safety and welfare of his employee.

Caustic Soda Dissolving Tank Showing Air, Steam and Water Connections

Standard Charts and Instruments

By Fred Emmarr
Dayton, Ohio

Many plants carry an unnecessarily large number of different charts, instrument parts and elements for recording thermometers, pressure gages, pyrometers, flow-meters and so on. It is remarkable in how many different places the same range of thermometer or pressure gage can be used. In large industrial plants a great number of instruments are necessary. For each instrument a supply of charts, a spare element, a file for each chart number and a great many sundry items are involved with each instrument.

The number of accessories carried for each instrument vary in different plants. Due to the delay in receiving charts from the date of original requisition—as long as two months for special charts—most plants keep at least three month's supply ahead at all times. Many plants carry a six months' stock, while a few may go longer. It is unsafe to let the

stock run down too low as any delay may result in chartless instruments. Constant care is required to keep up a large stock of charts.

One can readily see the immense advantage of having as few different types and ranges of recording instruments as possible. There is rarely any excuse for having a large number of odd instruments of different makes, sizes, types and ranges.

The following will point out the various items worth considering in the purchase of instruments:

1—Standardize as far as possible upon one manufacturer of instruments. This assists the ordering of supplies, helps accounting, obtains better service, and renders equipment uniform.

2—Determine the number of instruments, their ranges, types and so on required. Tabulate these and where possible use the same instrument. For example, for steam pressures throughout the plant, ranging from say 100 to 175 lb., choose a chart range of say from 0 to 250 lb. and use this same instrument for all steam pressures. At the same time this will take care of feed water pressure, and possibly compressed air, water, and other pressures, without too great a sacrifice of accuracy of reading. In this way one chart number covers all of these charts, with one stock requirement. The elements in these gages are identical, as are the pens, arms, glasses, screws and clocks, so that very few spares are needed for all these instruments. It is not often that two break at the same time. The broken part can be repaired or replaced before another gives out.

3—Connect all instruments uniformly. If drilled panels are used, use instruments with back connections. Otherwise use bottom connections, but make them all the same.

4—Endeavor to use the same sized bulbs on all recording thermometers. This means standard sized protection wells, holes in piping, bushings, etc. It is not advisable to use a standard lead length, as the distance of the well from the instrument board will vary greatly.

5—Use the same types of cases. Make them all nickel, black, water-proof, pear-shaped or round, but have them all uniform in appearance. Use very neat gage-boards, all uniform in lay-out if possible.

6—Use the same sized charts on all instruments, 8 in., 10 in. or 12 in. File the charts in a cabinet or receptacle that will give greatest satisfaction if the charts are all the same size.

7—Mark the charts uniformly, neatly and concisely. Use date stamps rather than pen or pencil, as well as stamps for the title or location if possible.

8—Periodically check all instruments, keeping precise records thereof. Conscientious and accurate checking is important.

9—Periodically check the stock of charts and parts, making a routine of ordering at regular intervals. Carry a definite supply ahead at all times.

10—Make each chart tell its story accurately and without failures resulting from run-down clocks, non-inking pens, wrong charts, etc. The supervisor should know of undue variations or happenings shown by the record, their causes and remedies.

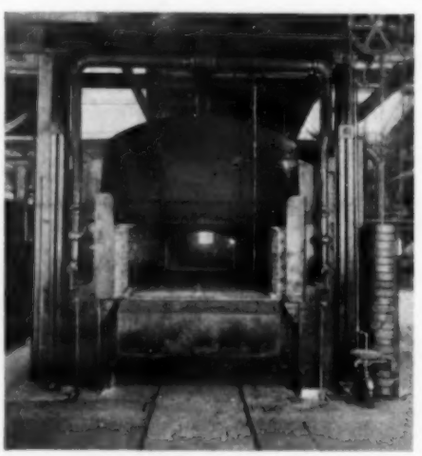
11—Keep all instruments clean and in perfect condition, so that operators will respect them and use them as friends to guide their work.

Nothing adds more to the efficiency and attractiveness of a plant than the neat appearance, accuracy, and free use of good instruments. They tell a valuable story, in fact they write it down; to be of value these stories must be true and understandable.

Indirect Firing Improves Furnace Operation

The Primary Battery Division of Thomas A. Edison, Inc., has recently modernized its battery of oil-fired furnaces that are used in baking cupric oxide battery plates. The old style furnaces, much like the new except for changes in the method of heating, were fired down through the arch by means of six open flame burners which permitted direct impingement of the flame upon the ware carried on the two furnace cars. The new furnaces, operated at 1,500 to 2,000 deg. F., are similar to the old in size and design with the exception that double carboradiant chambers of silicon carbide tile, supplied by the Carborundum Company, are built along the sides of the furnace behind 3-ft. bridge walls, extending from each corner to a point near the furnace wall center. The four burners now used may thus fire into the chambers so that complete combustion takes place before the gases come in contact with the furnace charge.

The furnaces are 20 ft. 3 in. long, 5 ft. 6 in. wide and 7 ft. 6 in. high at the arch center. Their average capacity is from 13,000 to 14,000 lb. of battery plates per charge with a maximum of 16,000 lb. for steady operation. Each burner fires into the lower carboradiant duct so that the gases pass to the end and return through the upper duct which has vents into the furnace throughout its length. Gases passing from the vents go over the bridge wall, through the charge and then through false bottoms of the cars to vents in the side wall. Oil of 26 deg. Bé. constitutes the fuel, while air is supplied by a blower, powered by a 15 hp., 3,600 r.p.m. motor.



Carboradiant Chambers are at Either Side of This Furnace

The use of carboradiant chambers has not only improved the quality and uniformity of the baking operation, but has also decreased fuel consumption by 40 per cent and increased the furnace capacity by 26 per cent per run. The overall baking cycle has been reduced from 21-30 hours to 12 hours, eliminating the necessity for supervision for two shifts or more, instead of the present one. There is now no chance for the flame to reduce the oxide, and heating is found to be much less localized.

The first of the new type furnaces was installed in 1925. Since then it has had the equivalent of two full years under heat and still shows no deterioration of the carboradiant chambers, which have, at the same time, needed no repairs. Despite the very liberal allowance of three year replacement for the chambers, and a consequent high fixed charge applied to the product, total baking cost is reduced 31.6 per cent. This occasions a saving of $3.50 baking cost per ton of product, or $5,950 per year, a net annual return of 125 per cent on the added investment.

For the sake of comparison, the following figures, based on 11 typical heats in the new furnaces, and 6 in the old, are given:

	Old	*New*
Average charge	5.7 tons	7.2 tons
Overall baking time	21-30 hours	12 hours
Fuel per ton	69 gal.	41.1 gal.
Attendance per charge	2 shifts or more	1 shift
Baking cost per ton	$11.08	$7.58

Acknowledgment is made to the A. C. Nielsen Company of Chicago for the use of its survey covering the foregoing data.

Simple Signal Detects Fan Stoppage

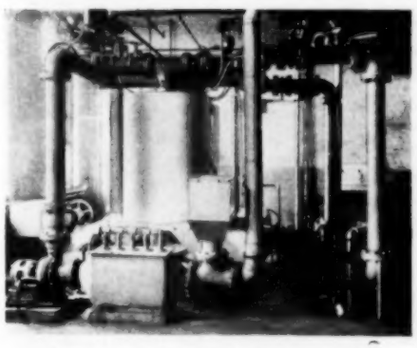
A recent issue of *Coal Age* suggests a very simple means for constructing a warning device that will give unmistakable notification of stoppage of a fan used to move air or gas through a duct. The method has the advantage that the signal may be given at a point distant from the location of the apparatus. It consists simply of a U-shaped pipe connected at one end to the side of the duct and partially filled with water or other suitable liquid. If the duct is under pressure, the open leg of the U should be longer than the end connected to the duct. If the duct is under suction, the open leg is shorter.

A cork float placed in the open end of the tube is provided with suitable electrical contact points so that the circuit may be kept open as long as the fan is in operation. For a pressure duct, contact is made as the float drops in case of cessation of pressure. When the duct is under suction, contact is made as the float rises in case of interruption of the fan service. This contact is made to operate a light or bell placed at any desired location when a warning is necessary.

EQUIPMENT NEWS *from* MAKER *and* USER

Silica Gel Gas Driers

A new line of equipment for the drying and purifying of various gases under pressure and for the conditioning of air is announced by the Silica Gel Corporation, Garrett Building, Baltimore. In general, the equipment includes duplicate absorbers packed with silica gel for removing moisture and



Silica Gel Air Conditioning Unit

contaminating lubricant from the gas compressor as well as undesirable impurities from such gases as carbon dioxide. An air heater is provided from which hot air may be circulated through an absorber requiring regeneration for the purpose of driving moisture and impurities from the gel. In some installations coolers are also provided. The accompanying illustration is that of an air conditioning unit which provides cooled and thoroughly dried air for use in the conditioning of cork. This equipment requires no refrigeration for drying the air and needs only cooling water for providing the requisite cooling.

Swinging Crane

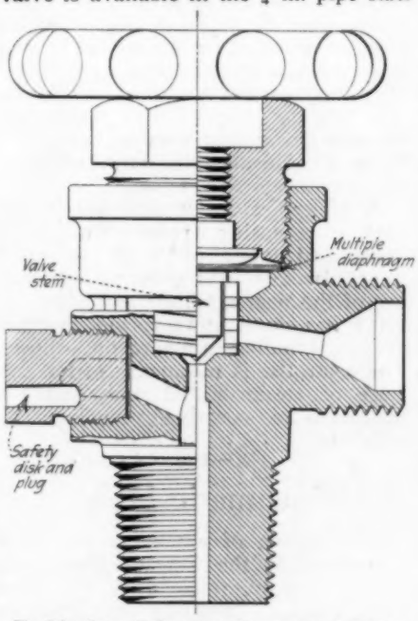
A small swinging crane known as the "Loadmaster," built upon an industrial tractor, and powered by the tractor, has been placed on the market by Frederic H. Poor, Inc., 50 Church St., New York. The crane is not only mobile but may be used to haul loads or trailers if desired. The 10-ft. swinging boom has a swing-arc of 240 deg., permitting material to be handled in almost any position without moving the crane. Loads varying between 1,000 and 3,000 lb., depending upon the position of the boom, may be handled. Through the use of adjustable telescopic outriggers which are available, loads heavier than the stated minimum are capable of being handled in the least favorable boom position. The new crane is recommended for use in all connections where manual labor is disadvantageous and the loads are not within reach of ordinary hoist service.

New Acid Resisting Brick

"Acido" is the name of a new acid resisting brick which has recently been developed by the General Refractories Company, Philadelphia. The brick is machine made, assuring accurate sizing. It is made from a clay especially selected for its acid resistance and is burned to a dense, impervious body. The brick are recommended for any construction or equipment subject to acid attack. As they are made at several of the company's plants, it is suggested by the makers that it is possible to take advantage of short freight hauls to consuming points.

Packingless Valve

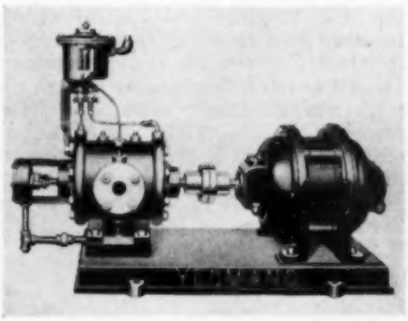
A new valve for compressed gases such as oxygen, hydrogen, nitrogen, helium and air has been developed by the International Oxygen Company, Newark, N. J. The valve is without packing, which is claimed as its principal feature. The accompanying drawing shows that this is accomplished by means of a diaphragm which communicates pressure from the hand wheel to the valve stem. The valve body is constructed of forged brass. A safety feature is incorporated, consisting of a frangible disk backed by fusible metal which will melt at 212 deg. F. and release at 2,600 to 2,800 lb. pressure. The valve is available in the ¼ in. pipe size.



Packingless Valve for Compressed Gases

Rotary Direct Connected Compressor

A recent development in small compressors for pressures up to 50 lb. has been announced by Yeomans Brothers Company, 1434 Dayton Street, Chicago. In the smaller sizes the compressor may be operated at 1,750 r.p.m. with no more



Positive Displacement Rotary Compressor With Oiler, Water Jacket and Circulating Pump

noise, it is said, than that of the direct connected motor. The possibility of operating at high speeds permits the use of higher speed, more inexpensive motors and eliminates the use of speed reducing devices.

The compressor is of rotary, multivane construction without actual contact between vanes and casing, resulting, the makers claim, in a pulsationless discharge, low wear and volumetric efficiency comparing favorably with reciprocating compressors. Mechanical losses are reduced through the use of roller bearings on the shaft.

Low pressure machines and those intended for intermittent service at somewhat higher pressures are provided with air-cooled casings. For higher pressures, water-jacketed casings are furnished, either with a centrifugal circulating pump driven from the shaft for use with a gravity cooling tank, or without the pump for use of city water. The compressor is supplied with a Yeomans automatic oil economizer which provides lubrication during operation of the machine and automatically stops the flow of oil when the compressor is shut down. The usual stuffing boxes are replaced by a seal of special metallic packing rings. The manufacturers suggest the compressor for any service within the pressure limit indicated.

Fluor-Spar Sample

The U. S. Bureau of Standards has prepared a standard analyzed sample of fluor-spar which contains 94.9 per

cent calcium fluoride, 1.9 per cent silica, 1.0 per cent carbon dioxide, 0.14 per cent sulphur, 0.34 per cent zinc and 0.25 per cent lead. This sample, No. 79 of the Bureau's series, is priced at $2.50 for 60 grams. A complete list of standard samples, analyses, fees and so on is given in the Bureau of Standards Supplement to Circular No. 25, sent upon request by the Bureau.

Cushioned Air Compressor Valves

The Pennsylvania Pump & Compressor Company, Easton, Pa., announces a new improved cushioned air compressor valve for which extreme simplicity of construction is claimed. The valve is identical in principle with previous Pennsylvania air compressor valves, except that the guard and seat are secured together by a retaining ring in place of screws. This permits larger port areas as well as interchangeability in both the inlet and discharge assemblies. The principal feature of the valve, the air cushioned pocket in the guard, prevents the valve from striking the metal of the guard and is said to add greatly to the life and quietness of the valve.

Unit Heater

A recent development of the Bayley Blower Company, Milwaukee, Wis., is a unit heater known as the "Chinookfin." It consists of a welded sheet steel casing housing a fan driven by a small motor, and the radiation surface, which consists of copper tubes with extended copper fin surface. Each heating tube is individually mounted so that it is claimed there is no danger of failure from differential expansion. The tubes are said to be easily removable in case a repair is needed, when any single tube may be removed separately as desired. The heater units are light in weight, and may be supported directly from the pipe line if desired. Units may be installed singly, or in combination, to give any desired capacity.

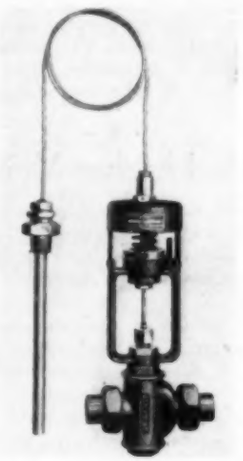
Explosion-Proof Motor

A new motor, available for alternating current in sizes up to 5 hp. and known as the Type Ex has recently been placed upon the market by the Louis Allis Company, Milwaukee, Wis. The new motor, illustrated herewith has been listed by the Underwriters' Laboratories for operation where any petroleum products are made, used or handled. It is of the self-ventilated type, and is said to be only slightly heavier than an open motor. The manufacturers recommend the motor for use in connection not only with petroleum products, but also with various flammable solvents. It is stated that the motor will shortly be available in sizes up to 10 hp.

Self-Ventilated Explosion-Proof Motor

Automatic Temperature Controller

A new self-contained temperature regulator has been placed upon the market by the American Schaeffer & Budenberg Corporation, 338 Berry Street, Brooklyn, N. Y., and is shown in the accompanying illustration. The instrument consists of a temperature responsive element which, through a bellows, actuates the opening and closing of the valve disk directly.



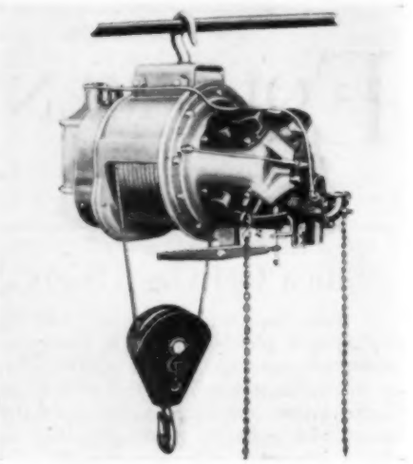
Self-Contained Controller

An operating spring of large diameter may be varied in tension by the setting of an easily adjusted nut so as to effect regulation of the controller. The device may be supplied in a number of temperature ranges outside the possibility of adjustment of any individual instrument.

A safety feature is provided in the form of a spring placed between the upper and lower parts of the valve stem. In case of accidental overheating of the responsive element after the valve has seated, this spring is compressed, avoiding injury to the bellows. The controller is recommended for any piece of steam heated equipment for which a self-contained regulator is suitable.

Pneumatic Hoist

A new line of air hoists has been announced by the Chicago Pneumatic Tool Company, 6 E. 44th St., New York. This is known as the CP series and makes available hoists of 2,000, 3,000 and 4,000 lb. capacity. Motors are 4-cylinder, single-acting, and substantially vibrationless. A balanced type of control valve is said to assure smooth and positive control. New features claimed include greater lifting speed, pressure lubrication, and general refinement of design.



Pneumatic Hoist

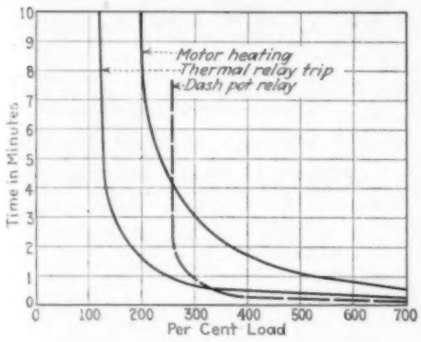
Pocket Pyrometer

A radiation pyrometer so small that it can be carried in the pocket has been announced by the Colonial Supply Company, 217 Water St., Pittsburgh. The new pyrometer, known as the K & S, is of the total radiation type, in which the radiation from a hot body is focused by means of a lens carried in the telescope-like body of the instrument upon a tiny bimetallic spiral. A pointer, joined to the spiral, moves in front of a scale within the instrument and within the line of sight of the operator, permitting simultaneous view of the radiating body and the deflection of the spiral due to the radiation. The scale is calibrated directly in temperature degrees and the instrument may be procured in various ranges from 1,100 — 2,600 deg. F. to 1,100 — 4,000 deg. F.

A compensating spiral adjusts the position of the scale and eliminates the variable of instrument temperature. With all parts inclosed within the instrument body and no manipulation required, it is claimed that the new pyrometer is not only accurate but that it is usable by inexperienced labor.

Thermal Overload Relay

The Westinghouse Electric & Mfg. Company, Pittsburgh, has announced a new thermal overload device which permits a motor to operate in case of overload until such an overload would cause dangerous overheating. The characteristics of the thermal device follow the heating curve of the motor, so that the motor will not be shut down instantly in case of a high, but harmless overcurrent. The relay is so



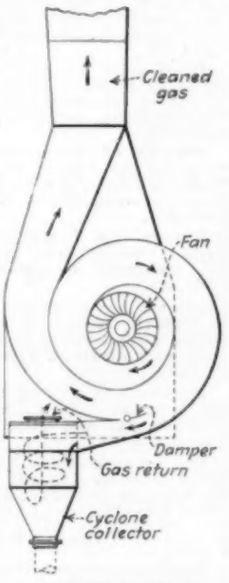
Characteristics of the New Relay

adjusted that the tripping time depends upon the magnitude of the overload and decreases as the overload increases, but with ample rapidity for complete motor protection.

It is claimed that with the new device, the safe overload capacity of the motor may be fully utilized whereas, with the usual type of dash pot relay, an instantaneous overload greater than that for which the relay is set will shut down the motor, while with a prolonged overload of less than that for which the relay is set, no protection whatever will be provided.

Cinder-Removing Stack

The Prat-Daniel Corporation, 101 Park Ave., New York, announces its new type 4 Thermix Stack for removing cinders, dust and fly ash from furnace flue gas. It is simply explained in connection with the accompanying drawing. An induced-draft fan discharges the dust- and cinder-laden gases through a prolonged involute which tends to throw the particles of solids to the outside where they are skimmed off, with a portion of the gas, and discharged through a cyclone collector to settle the dust. The gas, so bypassed, is returned to the suction of the fan.



Centrifugal Dust-Removing Stack

The following cleaning efficiencies are claimed for the stack:

Over 93 per cent elimination of dust
50 to 100 mesh
Over 85 per cent elimination of dust
150 to 200 mesh
Over 75 per cent elimination of dust
250 to 300 mesh

The power consumption is said to be low and regulatable by means of the skimming damper, which latter also regulates the degree of dust elimination.

Power Failure Warning

The General Electric Company of Schenectady, N. Y., has brought out a new signalling relay that may be connected across two legs of a power supply to give warning if the power should fail or the voltage drop. The devise is small and inexpensive and is given the designation CR-2904-F-1. It consists of a solenoid having a laminated armature of three sections, the center leg of which is attached to an insulating arm which operates the contact tips. When power fails, or with suitable adjustment, when the voltage drops, a circuit connected to the contact tips is made to actuate a bell, horn or other signal.

Manufacturers' Latest Publications

Hardinge Company, York, Pa.—Bulletin AH-146—Concerning the grinding of burned lime.

Lewis-Shepard Company, 164 Walnut St., Watertown Station, Boston, Mass.—Folder on "Shipping on Skid Platforms."

Combustion Engineering Corporation, 200 Madison Ave., New York, N. Y.—Reprint from Power on "How Powdered Coal Stands Today."

Dry Quenching Equipment Corporation, 200 Madison Ave., New York, N. Y.—Bulletin on the Sulzer dry quencher, type C, a modification of the Sulzer system for small gas plants.

Esterline-Angus Company, Indianapolis, Ind.—Bulletin 828—Presents a description of manufacturing operations in the Esterline-Angus plant.

International Nickel Company, 67 Wall St., New York, N. Y.—Two publications as follows: "A Pictorial Panorama of Progress,"—use of nickel steel in various industries; also "Use of Nickel Steel in the Hornet and Wasp Aircraft Engines."

Fusion Welding Corporation, 103d St. and Torrence Ave., Chicago, Ill.—Bulletin No. 129—"The Influence of Manganese in Steel Welding Rods."

Crouse-Hinds Company, Syracuse, N. Y.—Bulletins as follows: Form 7, describing the new Obround Condulets. Also folder No. 54, "Installation of Wiring Devices on the New Obround Condulets."

American Solvents & Chemical Corporation, 285 Madison Ave., New York, N. Y.—Catalog describing the company's plants and products together with complete information on denaturants for specially and completely denatured alcohol. Also contains tables of assistance to the alcohol user.

Robinson Mfg. Company, Muncie, Pa.—Folder 205—Describing process equipment made by this company.

Armco Culvert Manufacturers Association, Middletown, Ohio.—Bulletin H-34—Discussion from various standpoints of the selection of culverts and drains on the basis of costs per year.

Bailey Meter Company, 1050 Ivanhoe Road, Cleveland, Ohio.—Bulletin 35—Describing the principle of Bailey Meters and the application to the measurement of numerous organic and inorganic gases.

Semet-Solvay Engineering Corporation, 40 Rector St., New York, N. Y.—Pamphlet Nos. 349, 351, 352—Covering, respectively, the Steere water gas machine, this company's bulletin No. 43 on carbureted water gas and Steere welded steel pipe.

Celite Products Company, Los Angeles, Calif.—Bulletin 104—The 1928 lecture on high temperature insulation; bulletin 108, insulation of industrial furnaces and ovens; bulletins 338, 339 and 340, the use of Celite in concrete.

General Electric Company, Schenectady, N. Y.—Publications as follows: GEA-19E, inclosed magnetic switches; GEA-23B, indoor disconnecting switches; GEA-71B, wound rotor induction motors; GEA-81B, high torque double squirrel cage motors; GEA-451A, MT control for direct current mill and crane motors; GEA-556B, automatic welding head and control; GEA-723, coal and ore bridge equipment; GEA-572A, automatic switching equipment; GEA-781A, steam engine driven generating sets; GEA-821A, pressure and vacuum switches; GEA-857A, outdoor switching equipment; GEA-861, class BM motors and control; GEA-874B, arc welder; GEA-937A, Textolite products; GEA-952, automatic transfer switch; GEA-1028, Form J, Class BU totally inclosed motors; GEA-1052, general purpose synchronous motors.

Chicago Pneumatic Tool Company, New York, N. Y.—Publications as follows: Bulletin 700, power driven duplex air compressors; bulletin 720, straight line steam and power driven air and gas compressors; bulletin 773, class A-04 semi-Diesel oil engines.

Quartz et Silice, 5, Rue Cambaceres, Paris, France.—A pamphlet in French describing the methods of production of fused silica used by this company.

American Manganese Steel Company, Chicago, Ill.—A brochure describing the history, composition and a large number of uses of manganese steel.

The Norton Company, Worcester, Mass.—Illustrated booklet concerning the character and uses of Norton products such as abrasives, refractories and non-slip flooring materials.

Jeffrey Mfg. Company, Columbus, Ohio.—Catalog 450—New descriptive catalog covering the Jeffrey swing hammer pulverizers. Gives examples from actual practice in the pulverizing of 54 different materials.

The Falk Corporation, Milwaukee, Wis.—Bulletin 180 — Completely descriptive of Falk flexible couplings.

Benjamin Electric Mfg. Company, Chicago, Ill.—Publications as follows: "A Guide to Productive Lighting for Industry,"—data on correct lighting and a description of a large number of types of lighting equipment. "Light and Production," a discussion of lighting for the executive.

Shallcross Control Systems Company, Milwaukee, Wis.—A discussion of gas regulating instruments and equipment for coke plants.

Laboratory Construction Company, Kansas City, Mo.—A description of equipment for nitrogen determination.

Foster Wheeler Corporation, 165 Broadway, New York, N. Y.—Catalog No. 304—"Foster Superheaters" described in connection with many kinds of boiler installations and in pipe stills.

Acheson Graphite Corporation, Niagara Falls, N. Y.—Bulletin on industrial lubrication specifying the proper form of "Gredag" for many lubrication problems.

Eureka Machine Company, 2610 Vega Ave., Cleveland, Ohio.—Descriptive of the double action Eureka duplex drum washer.

Tirrill Gas Machine Lighting Company, 50 Church St., New York, N. Y.—Showing the application of gas machine gas for industrial as well as domestic purposes.

Leeds & Northrup Company, 4901 Stenton Ave., Philadelphia, Pa.—Catalog No. 80—Discusses resistance thermometers and accessories for controlling, recording and indicating temperatures.

Research Corporation, 25 West 43d St., New York, N. Y.—Publications as follows: Bulletin 200, on the history and principles of electrical precipitation; bulletin 202, discussing the detarring of manufactured gas by electrical precipitation.

Barber Asphalt Company, Philadelphia, Pa.—A bulletin on "Curcrete," an asphalt emulsion for curing concrete.

Erie City Iron Works, Erie, Pa.—Three bulletins concerning the Erie City 3-drum water tube boiler, its applications and the "Unitype" pulverizer.

Foxboro Company, Foxboro, Mass.—Folder DMF-559—"A Cloud of Steam Is Golden Fleece,"—heat losses in vaporizing water unnecessarily.

Diehl Mfg. Company, Elizabethport, N. J.—"Orange Stock List," a stock list of motors and fans issued semi-monthly.

Sigmund Cohn, 44 Gold St., New York, N. Y.—A bulletin describing "Precision" platinum ware.

Power Plant Equipment Company, 1737 Walnut St., Kansas City, Mo.—A booklet giving cooling data and other information on Marley spray cooling equipment.

Electric Controller & Mfg. Company, Cleveland, Ohio.—A folder describing the use of separator magnets to insure against accidents from tramp iron.

A. C. Horn Company, Long Island City, N. Y.—A. I. A. file No. 7—A folder containing numerous data sheets on concrete waterproofing materials.

L. Oertling, Ltd., 65 Holborn Viaduct, London, E.C.1.—Describing a wide variety of British built precision balances.

Schutte & Koerting Company, Philadelphia, Pa.—Publications as follows: Bulletin 5-H, discussion of a number of types of multi-nozzle, single and multi-stage steam jet vacuum pumps, boosters and exhausters. Bulletin 7-E, price list of Everdur fittings and valves with information on jets of the same material.

P. H. & F. M. Roots Company, Connersville, Ind.—Publications as follows: General bulletin 10-B1—Information on Roots blowers, pumps and meters with a list of applications. Bulletin 40-B2, discusses the new Roots positive displacement meter.

PATENTS ISSUED
Sept. 4 to Sept. 25, 1928

PAPER, PULP, GLASS AND SUGAR

Method of and Apparatus for Making Multiply Paper. George L. Bidwell, Riegelsville, Pa., assignor to The Warren Manufacturing Company, Riegelsville, N. J.—1,682,826.

Method of Manufacturing Straw Pulp and Paper. Charles H. Dedrick, Drexel Hill, Pa., assignor to Philadelphia Quartz Company.—1,682,834.

Process of Chemically Treating and Washing Pulp. George A. Richter and Milton O. Schur, Berlin, N. H., assignors to Brown Company, Berlin, N. H.—1,683,262.

Process for the Production of Waterproof Textile Material, Paper, and the Like. Carl Knopf, Hamburg, Germany.—1,683,470.

Beating Engine. John D. Haskell, Fulton, N. Y., assignor to Dilts Machine Works Incorporated, Fulton, N. Y.—1,683,546.

Pulp Beater. Lorenzo M. Avenson, St. Paul, Minn.—1,683,597.

Recovery of Waste Gases in the Production of Sulphite Pulp. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,683,628.

Method and Apparatus for Washing Pulp. Charles A. Johnson, La Tuque, Quebec, Canada, assignor to Brown Company, Berlin, N. H.—1,683,782.

Method of and Apparatus for Forming Plate Glass. George E. Howard, Butler, Pa., assignor to Hartford-Empire Company, Hartford, Conn.—1,684,030.

Method of Producing Glass. Max Thomas, Weisswasser, Oberlausitz, Germany, assignor to Patent-Treuhand-Gesellschaft für Elektrische Gluhlampen m. b. H., Berlin, Germany.—1,684,332.

Apparatus for Making Bisulphite Liquor. Jacob Darre Jenssen, New York, N. Y., assignor to G. D. Jenssen Company, New York, N. Y.—1,684,494.

Glass Furnace. Thomas B. Hart, Libow, W. Va., assignor of one-half to Adamston Flat Glass Company, Clarksburg, W. Va.—1,685,053.

Apparatus for Separating Liquid from Pulp Fibers. John H. Hoyt, Hazleton, Pa., assignor to United Filters Corporation, New York, N. Y.—1,685,084.

Process for Recovering Sugar Values. Robert C. Campbell, Millburn, N. J., assignor to United Filters Corporation, Hazleton, Pa.—1,685,118.

Apparatus for Delivering Charges of Molten Glass. Leonard D. Soubier, Toledo, Ohio, assignor to The Owens Bottle Company, Toledo, Ohio.—1,685,143.

Method and Apparatus for Screening Fluids. Frank L. Allen, Montclair, N. J.—1,685,621.

Machine for Paper-Making Processes. Harold D. Wells, Glens Falls, N. Y.—1,685,736.

Preparation of Betaine Hydrochloride, Etc. Donald K. Tressler, Pittsburgh, Pa., assignor to Larrowe Construction Company, Detroit, Mich. *Treating residual liquors of beet molasses.*—1,685,758.

RUBBER, RAYON AND SYNTHETIC PLASTICS

Apparatus for Spinning Artificial Silk. Gustav Otto, August Hartmann and Gotthard Bauriedel, Barmen, Germany, assignors, by mesne assignments, to American Bemberg Corporation.—1,682,797.

Manufacture of Rubber and the Like. Philip Schidrowitz, London, England, assignor to Vultex Limited, Jersey, Channel Islands, England.—1,682,857.

Cooling Rubber Tire Treads. Hugo C. Weisse, Milwaukee, Wis., assignor to The Fisk Rubber Company, Chicopee Falls, Mass.—1,682,876.

Synthetic Resin and Method of Producing the Same. Linwood T. Richardson, New Brunswick, N. J., assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—1,682,934.

Artificial Thread and Process for Making Same. Leon Lilienfeld, Vienna, Austria.—1,683,199-200.

Process of Making Antistatic Nitrocellulose Film. Ray L. Stinchfield, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,683,315.

Process of Making Chloroform-Soluble Cellulose Acetate. Harry Le B. Gray and Cyril J. Staud, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,683,347.

Process for Making Substantially Homogeneous Masses of Polymerized Styrol from a Nonhomogeneous Mass of Polymerized Styrol. Iwan Ostromislensky and Morris G. Shepard, New York, N. Y., assignors to The Naugatuck Chemical Company, Naugatuck, Conn.—1,683,401-5.

Viscose-Treating Apparatus. Samuel A. Neidich, Edgewater Park, N. J.—1,683,478.

Soluble and Fusible White Acetone Resin and Process of Making Same. Carleton Ellis, Montclair, N. J.—1,683,535.

Direct Production of Rubber Goods from Rubber Dispersions. Paul Klein, Budapest, Hungary, and Albert Healey, Birmingham, England, assignors to The American Anode Incorporated, New York.—1,683,588.

Making Cellulose Ethers and Alkali Cellulose. Leon Lilienfeld, Vienna, Austria.—1,683,681.

Preparation of Alkali Cellulose and Cellulose Ethers. Leon Lilienfeld, Vienna, Austria.—1,683,682.

Artificial Resin and Making the Same. Fritz Seebach, Gotha, Germany, assignor to Bakelite G. m. b. H. Berlin-Charlottenburg, Germany.—1,683,701.

Process for Purifying Phenol Formaldehyde Resins. Fritz Seebach, Erkner, near Berlin, Germany, assignor to Bakelite G. m. b. H., Berlin, Germany,—1,683,702.

Distillate Distributor for Hydro-Carbon Distillation Systems. Francis M. Hess, Chicago, Ill.—1,683,778.

Cellulose Ether and Process of Making Same. Leon Lilienfeld, Vienna, Austria.—1,683,831.

Resinous Composition of Matter and Process of Making Same. Augustus E. Maze, Orange, N. J.—1,683,835.

Rubber Composition and Process. Charles H. Campbell, Pittsburgh, Pa., assignor to American Glue Company, Boston, Mass.—1,683,862-4.

Process of Preparing Phenol-Formaldehyde Condensation Products. Grigori Petroff, Moscow, Russia, and Peter Shestakoff, Paris, France.—1,684,142.

Method of Weighting Silk and the Product Thereof. Robert J. O'Brien, Jr., Belleville, N. J., assignor to Collway Laboratories, Inc., Newark, N. J. *Applying rubber in solution.*—1,684,286.

Textile Dye. Winthrop S. Lawrence, New York, N. Y.—1,684,401.

Synthetic Resin Fiber Board. Albert L. Clapp, Danvers, Mass.—1,684,755.

Production of Resins. Irvin H. Jones, Manhattan, Ill., assignor to The Koppers Company, Pittsburgh, Pa.—1,684,868.

Spinning Pump. Charles W. Lawser, Bala, Pa., assignor to Wicaco Screw & Machine Works, Inc., Philadelphia, Pa.—1,684,871.

Method for the Manufacture of Plastic Compounds. Georges Emmanuel Zelger, Montreuil, France, assignor, by mesne assignments, to du Pont-Pathe Film Manufacturing Corporation, Wilmington, Del.—1,685,443-4.

Method and Apparatus for Making Artificial Silk. James M. Leaver, Oakland, Calif., assignor to The Pacific Lumber Company, San Francisco, Calif.—1,685,640.

PETROLEUM TREATMENT AND PRODUCTS

Process and Apparatus for Cracking Oil. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,682,742.

Halogen Treatment of Oil Shale. Gustav Egloff, Independence, Kans., assignor to Universal Oil Products Company, Chicago, Ill.—1,682,743.

Process and Apparatus for Treating Petroleum Oil. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,682,744.

Method of Distillation of Petroleum. Edward W. Isom, Winnetka, Ill., assignor to Sinclair Refining Company, Chicago, Ill.—1,683,135.

Fractional Distillation of Petroleum. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,683,150.

Method and Apparatus for Distilling Petroleum Oils. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,683,151.

Apparatus for Cracking Hydrocarbons. Eugene C. Herthel, Chicago, Ill., assignor to Sinclair Refining Company, New York, N. Y.—1,683,184.

Distillation of Crude Petroleum. Edward W. Isom, Scarsdale, N. Y., and Eugene C. Herthel, Chicago, Ill., assignors to Sinclair Refining Company, New York, N. Y.—1,683,193.

Art of Improving Mineral Oils. Forrest Wayland Eley, Newark, Ohio, assignor, by mesne assignments, to Anglo-California Trust Company.—1,683,288.

Art of Refining Oil. Harry F. Glair and Oscar E. Bransky, Whiting, Ind., assignors to Standard Oil Company, Whiting, Ind.—1,683,289.

Apparatus for Cracking Oil. Gustav Egloff, Chicago, Ill., and William R. Howard, Washington, D. C., assignors to Universal Oil Products Company, Chicago, Ill.—1,683,766.

Process of Treating Oils. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,683,767.

Process for Treating Residual Oils. Lyman C. Huff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,683,826.

Method of Treating Oil Shales and Other Bituminous Materials. William W. Blaisdell, New York, N. Y.—1,684,007.

Process of Refining Oils. Sijbren Tijmstra, Madison County, Ill., assignor to Roxana Petroleum Corporation.—1,684,159.

Counterflow Treatment of Petroleum Oils. Ralph A. Halloran, Berkeley, Calif., assignor, by mesne assignments, to Standard Oil Company of California, San Francisco, Calif.—1,684,489.

Process of Treating and Fractionating Cracking-Plant Vapors. Eugene H. Leslie and Edwin M. Baker, Ann Arbor, Mich.—1,684,771.

Process of Treating Slack Wax. Benjamin L. Souther, Pittsburgh, and William A. Gruse, Wilkinsburg, Pa., assignors to Gulf Refining Company, Pittsburgh, Pa.—1,685,058.

Process of Extracting the Oily Bases from Crude Shale Oil. David T. Day, Washington, D. C.; Fred J. Goble administrator of said David T. Day, deceased.—1,685,315.

Process for Cracking Oils. Joseph G. Alther, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,685,476.

Process for Recovery of Vapors. Robert T. Osborn, Richmond, Calif., assignor, by mesne assignments, to Standard Oil Company of California, San Francisco, Calif.—1,685,501.

Process and Apparatus for Reconditioning Mineral Oils. Clarence J. Rodman, Wilkinsburg, and Max Hecht, Pittsburgh, Pa.—1,685,681.

Process and Apparatus for Converting Hydrocarbons. Lyman C. Huff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,685,488.

ORGANIC PROCESSES

Manufacture of Erythrene. Alexander T. Maximoff, New York, N. Y., assignor to The Naugatuck Chemical Company, Naugatuck, Conn.—1,682,919.

Metallo Mercapto Compounds and Process of Making Same. Walter Schoeller, Berlin-Westend, and Hans Georg Allardt, Berlin-Reinickendorf-West, Germany, assignors to the Firm Chemische Fabrik auf Actien (vorm. E. Schering), Berlin, Germany.—1,683,104-5.

Process for the Extraction of Butyric Acid and Its Homologues. Jacques Lefranc, Paris, France, assignor to Societe des Brevets Etrangers Lefranc & Cie., Paris, France.—1,683,198.

Atomizable Mobile Fuel Product. Arthur W. Burwell, Niagara Falls, N. Y., assignor to Alox Chemical Corporation, New York, N. Y.—1,684,125.

Catalytic Dehydrogenation. Martin Luther, Kurt Pieroh, and Erich Kranepuhl, Mannheim, Germany, assignors to I. G.

Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,684,634.

Purifying Organic Compounds Containing Oxygen. Otto Schmidt, Karl Seydel, and Albert Feller, Ludwigshafen-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,684,640.

Manufacture of Carbohydrate Derivatives. William Harrison, Manchester, England.—1,684,732.

Process for the Manufacture of Perylene. Charles Henri Marschalk, Paris, France.—1,684,738.

Cyanamide Oven. George E. Cox, Niagara Falls, N. Y., assignor to American Cyanamid Company, New York, N. Y.—1,684,758.

Manufacture of Solid Alkali Metal Salts of Organic Compounds. Karl Dobmaier, Leverkusen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,685,191.

Process of Acylating Carbohydrates. Edmund B. Middleton, Parlin, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,685,220.

Catalytic Oxidation of Anthracene. Alphons O. Jaeger, Crafton, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,685,635.

Halogenides of Aromatic Oxaminic Acids. Josef Haller, Wiesdorf, near Cologne-on-the-Rhine, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,685,698.

Inorganic Processes

Method of Making Bleach Liquor as By-Product in Salt Purification. Victor Yngve, Lakewood, Ohio.—1,683,431.

Method of Using High-Tension Electric Arcs for Treatment of Gases. Emil Edwin, Trondhjem, Norway, assignor to Aktieselskapet Norsk Staal Elektrisk-Gas-Reduktion, Trondhjem, Norway.—1,683,534.

Method of Manufacturing Sulphuric Acid. Walter A. Patrick and Ernest B. Miller, Baltimore, Md., assignors to The Silica Gel Corporation, Baltimore, Md.—1,683,694.

Method of Preparing Tungsten Oxide Gel. Walter A. Patrick and Earle H. Barclay, Baltimore, Md., assignors to The Silica Gel Corporation, Baltimore, Md.—1,683,695.

Method of Treating Sulphur. James W. Schwab, Gulf, Tex., assignor to Texas Gulf Sulphur Company, Bay City, Tex.—1,683,731.

Alloy. Russell Franks, Elmhurst, and Burnham E. Field, Douglaston, N. Y., assignors to Haynes Stellite Company.—1,684,131.

Electric Furnace for Producing Silicon Carbide. Harold E. White, Anniston, Ala., assignor to Federal Abrasive Company, Birmingham, Ala.—1,684,611.

Manufacture of Zircon Refractories. Le Roy Himes Minton, Metuchen, N. J.—1,684,739.

Process for Extraction of Salts from Aqueous Solutions. Demetrius George Zalocostas, deceased, Bondi, New South Wales, Australia, by Andrianna Zalocostas, executrix, Bondi, and John Velissaropulos, executor, Bellevue Hill, Australia, assignors to The Salt Production Syndicate Limited, Sydney, New South Wales, Australia.—1,684,935.

Electrochemical Process for Separating Iron from Aluminum. Francesco Giordani, Naples, Italy, assignor to Pomilio Brothers Corporation, New York, N. Y.—1,685,156.

Production of Commercial Borax from Rasorite by a Wet Method. Thomas M. Cramer, Long Beach, Calif., assignor to Pacific Coast Borax Company.—1,685,214.

Recovery of Sulphur. William H. Howard, Salt Lake City, Utah.—1,685,231.

Process of Controlling Rate of Oxidation. Hector Russell Carveth, Niagara Falls, N. Y., assignor to The Roessler & Hasslacher Chemical Company, New York, N. Y.—1,685,520.

Process of Improving the Qualities of Nickel-Beryllium Alloy. Georg Masing, Berlin, and Otto Dahl, Berlin-Charlottenburg, Germany, assignors to Siemens & Halske, Aktiengesellschaft, Siemensstadt, near Berlin, Germany.—1,685,570.

Process of Manufacturing Complex Hydrofluoric Salt. Max Buchner, Hanover-Kleefeld, Germany, assignor to Albert Meyerhofer, Zurich, Switzerland.—1,685,628.

Process for the Production of Nitrites. Eugene T. Drake, Omaha, Neb., assignor to The Cudahy Packing Company, Chicago, Ill.—1,685,629.

Magnesium Alloy and Method of Making Same. William R. Veazey, Cleveland Heights, Ohio, assignor to The Dow Chemical Company, Midland, Mich.—1,685,653.

Method for Synthetically Producing Ammonia. Georg Friedrich Uhde, Bovinghausen, Germany.—1,685,734.

Chemical Engineering Processes

Catalytic Apparatus. Alphons O. Jaeger, Pittsburgh, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,682,787.

Method of and Apparatus for Handling, Storing and Measuring Bulk Material Into Batches. William Mayo Venable, Pittsburgh, Pa., assignor to Blaw-Knox Company.—1,682,872.

Method of and Apparatus for Purifying Water. Christian Hülsmeyer, Dusseldorf, Germany.—1,683,780.

Method of Increasing the Efficiency of Zeolites in the Treatment of Water. Wolcott C. Foster, Rutherford, N. J., and Arthur S. Garrett, Drexel Hill, Pa.—1,683,967.

Method of Preserving Wood and Wood Preservative. Gilbert Gunn, Pollokshaws, Scotland.—1,684,222.

Method of Treating Garbage and the Like. Revere P. Kinkel, Buffalo, N. Y. *Drying, burning and ammonia recovery.*—1,684,448.

Process for the Production of Fertilizers. Max Paul Nitsche, Dresden, Germany. *From sulphite waste lye.*—1,684,712.

Copies of Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Photostatic copies of foreign patents may be obtained at the same address, prices being forwarded on application.

Art of Briquetting. Paul C. Mulligan, Seattle, Wash., assignor to Luther J. Hull, Isaac M. Foster, and himself.—1,683,094.

Gas Generator. Claude Winfield Botsford, Chicago, Ill., assignor to William W. Odell, Pittsburgh, Pa.—1,683,155.

Liquid Fuels. Elmer H. Records, Spokane, Wash.—1,684,685-6.

Acetylene-Gas Generator. August Valentour, McDonald, Pa.—1,684,979.

Process of Purifying Oils and Fats. Wilhelm Gensecke, Bad Homburg, Germany, assignor to American Lurgi Corporation, New York, N. Y.—1,685,195.

Liquid-Treating Material and Method of Making Same. Arthur Schreier, Vienna, Austria, assignor, by mesne assignments, to General Zeolite Company, Chicago, Ill.—1,685,204.

Apparatus for Electrically Heating Liquids. Gustav Baum, Weissenstein-on-the-Drau, Karnten, Austria, assignor to The Niagara Electro Chemical Company, Inc., New York, N. Y.—1,685,210.

Process for Heating Liquids by Electrical Energy for Distillation, Concentration, Provocation of Chemical Reactions, Etc. Gustav Baum, Karnsten, Austria, assignor to The Niagara Electro Chemical Company, Inc., New York, N. Y.—1,685,266.

Process and Apparatus for Treating Polluted Acid Wastes. John T. Travers, Columbus, Ohio, assignor, by direct and mesne assignments, to The Travers-Lewis Process Corporation, Columbus, Ohio.—1,685,300.

Treatment of Polluted Wastes. John T. Travers, Columbus, Ohio, assignor, by direct and mesne assignments, to The Travers-Lewis Process Corporation, Columbus, Ohio.—1,685,301.

Asphaltic Material and Method of Preparing Same. William C. West, Louisville, Ky., assignor to West Process Pavement Company, Incorporated, Louisville, Ky.—1,685,304.

Art of Transporting Mixed Materials. Karl R. Schuster, Hopatcong, N. J.—1,684,370.

Method for Purifying Gases. Georg Friedrich Uhde, Bovinghausen, Germany.—1,685,733.

Method of Conditioning Coated Materials. Gordon D. Harris, Freeport, N. Y., assignor to The Industrial Dryer Corporation, Stamford, Conn.—1,682,752.

Method of Recovering Sulphur Dioxide from Waste Gases. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,685,754.

Apparatus for the Separation of Oil from Oil-Containing Substances. Carl Drahn, Magdeburg, Germany, assignor to the Firm Fried. Krupp Grusonwerk Aktiengesellschaft, Magdeburg-Buckau, Germany.—1,685,534.

Catalytic Apparatus. Alphons O. Jaeger, Pittsburgh, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,685,672.

Diffusion Reaction. Hans Walter, Mainz-Mombach, Germany, assignor to Verein für Chemische Industrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,685,759

Apparatus and Equipment

Rotary Pump. Francis C. Peterson, Everett, Wash.—1,683,143.

High-Frequency Induction Apparatus. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company.—1,683,146.

Valve. James A. Bishop, Mascoutah, Ill.; Lulu H. Bishop administratrix of said James A. Bishop, deceased.—*Packless valve.*—1,683,153.

Vacuum Seal and Apparatus. Ogden Minton, Greenwich, Conn.—1,683,254.

Valve. Sven Johan Nordstrom, San Francisco, Calif., assignor to Merco Nordstrom Valve Company, San Francisco, Calif.—1,683,257.

Pulverizing Machine. Ernest T. Roebke, St. Louis, Mo., assignor to American Pulverizer Company, St. Louis, Mo.—1,683,304.

Tunnel Kiln for Ceramic Industry. Victor Selliez, St.-Ghislain, Belgium.—1,683,309.

Apparatus for the Generation and Distribution of Mercury Vapor and Sealing Means Therefor. Frank Short, Poughkeepsie, N. Y., assignor to Chemical Machinery Corporation.—1,683,310.

Barrel-Filling Apparatus. William Ernest, Martinez, and Emanuel H. Baer, Associated, Calif.—1,683,337.

Emulsifier. William Thordarson, New York, N. Y.—1,683,500.

Pulverizing Machine. Alexander M. Read, Columbus, Ohio.—1,683,627.

Tunnel Kiln. Harry M. Robertson, Cleveland, Ohio.—1,683,807.

Air-Lift Pump. Horace M. Staggs, Dallas, Tex.—1,683,930.

Subliming Apparatus. Herbert G. Stone, Bristol, Tenn.—1,683,931.

Drying System. Harry V. Mooney, Seattle, Wash., and William Wesley Hicks, San Francisco, Calif.—1,683,984.

Induction Pressure or Vacuum Furnace. Edwin F. Northrup, near Princeton, N. J., assignor to Ajax Electrothermic Corporation, Trenton, N. J.—1,683,986.

Dust Collector. John C. Moon, St. Louis, Mo.—1,684,067-8.

Waterproofing Paste. Gerald B. Dyde, Portland, Ore.—1,684,086.

Endless Spiral Conveyer. Joseph Oswell Bailey, Atlanta, Ga.—1,684,254.

Rotary Pump. Sherwood Hinds, St. Louis, Mo., assignor to St. Louis Pump & Equipment Company, St. Louis, Mo.—1,684,274.

Pump. Nelson H. Henderson, Syracuse, N. Y., assignor to Syracuse Industrial Gas Co., Syracuse, N. Y.—1,684,490.

Paint or Waterproofing Material and Process of Producing the Same. Frederick W. McRae, Eagle Rock, Calif., assignor to McRae Paint Products, Inc., Los Angeles, Calif.—1,684,593.

Ion Concentration Control. Irving B. Smith, Ambler, and Earl A. Keeler, Norristown, Pa., assignors to Leeds & Northrup Company, Philadelphia, Pa.—1,684,645.

Conveying Apparatus. Edgar B. Tolman, Jr., Chicago, Ill.—1,684,649.

Heater for Liquid-Heat-Transmission Systems. Daniel M. Luehrs, Cleveland, Ohio.—1,684,963.

Dewatering Apparatus. John T. Hoyt, Hazleton, Pa., assignor to United Filters Corporation, New York, N. Y.—1,685,085.

Drying Apparatus. Oliver W. Randolph, Toledo, Ohio.—1,685,338.

Absorption Refrigerating Apparatus. Alfred Richter, Doberitz, near Berlin, Germany, assignor to A.-G. Für Handels- und Industriewerte Glarus, Glarus, Switzerland.—1,685,340.

Shaker Conveyer. John H. D. Petersen and John W. Wilson, Chicago, Ill., assignors to Link-Belt Company, Chicago, Ill.—1,685,463.

News of the Industry

Textile Publication Merge With McGraw-Hill

AFFILIATION of the Bragdon, Lord and Nagle Company, publisher of *Textile World*, oldest business paper in its field, with the McGraw-Hill Publishing Company was recently announced by James H. McGraw, president of the latter organization. The consolidation adds a new and important division to the McGraw-Hill organization and increases its business, industrial and engineering publications to twenty-three.

In addition to *Textile World*, which was established in 1868, three years after the Civil War, the merger includes the Consolidated Textile Catalog, *Textile Advance News*, Official American Textile Directory, the American Knitting Trade Directory, and a group of technical books devoted to the textile industry.

The Bragdon, Lord and Nagle organization will operate as a separate division of the McGraw-Hill Company and its management will continue in the hands of the men who built it. Henry G. Lord will continue as president, Frank L. Nagle as chairman of the board and H. O. Barnes as secretary. Joseph H. Bragdon will be vice-president and general manager. Mr. Lord and Mr. Bragdon become members of the board of directors of the McGraw-Hill Publishing Company and Mr. Bragdon joins its executive committee.

In discussing the merger Mr. Lord said: "Those of us who have guided the destinies of the *Textile World* and the other properties of the Bragdon, Lord and Nagle Company will continue as members of the McGraw-Hill organization the work which has been closest to us through long years of publishing experience. But, now, we have added strength in our work from the association of not only the McGraw-Hill Publishing Company itself but of its president and other executives individually. Instead of standing alone in serving the great textile industry, we now have strong allies whose publishing experience covers the broad sweep of American business and industry.

In making his announcement Mr. McGraw said: "Merger of the Bragdon, Lord and Nagle Company with the McGraw-Hill organization gives added strength to *Textile World*. Uninterrupted, it goes right on with the big job its founders chose for it in those early days immediately after the Civil War. Its personality is in nowise changed and the men who built it still are its managers and its publishers. The merger simply means two strong organizations have joined hands to take *Textile World* further forward and to make it even a greater paper than it has been.

"Through the consolidation we shall achieve economies and greater publishing efficiency in the gathering of news, in field representation along editorial, advertising and circulation lines and in mechanical production. The textile industry itself will profit through better editorial service and more extensive and intensive help in distribution and advertising problems."

Ten Major Subjects Listed for Coal Conference

MORE THAN a hundred speakers representing twelve countries are tentatively listed to present papers at the Second International Conference on Bituminous Coal to be held under the auspices of the Carnegie Institute of Technology in Pittsburgh, Nov. 19 to 24, 1928, according to a preliminary program announced by president Thomas S. Baker.

According to the plans, ten major subjects are listed for discussion in addition to the addresses of a general nature to be presented by Lord Melchett (Sir Alfred Mond), the British capitalist, George Claude, the eminent French scientist, Professor Fritz Hofmann, the German scientist who makes synthetic rubber from coal, Dr. F. zur Nedden, of Germany, F. G. Tryon of the U. S. Bureau of Mines, and others.

Major subjects to be discussed, it is expected, will include "Pulverized Fuel," "Gas Production," "Liquefaction and Hydrogenation," "Fertilizers," "Origin, Composition and Classification of Coal," "High Temperature Carbonization," "Combustion in Furnaces," "Purification and Cleaning," "Tars and Oils," and "Low Temperature Processes."

As indicated in the list of major topics, the chief purpose of the coming conference will be to present the results of recent studies of coal that have to do with improved methods of utilization and combustion. The list of speakers includes the world's leading authorities on the latest developments in improved utilization of coal as a source of energy and power.

Italian Dye Industry Not in International Cartel

INFORMATION received by the Department of Commerce under date of October 3 establishes that Italian manufacturers have not joined the dyestuffs cartel which comprises leading producers in European countries. A statement from Washington says that the department was advised July 2 that the Italian dyes and explosives industries had become members of the international dyestuffs cartel and that dyestuffs imports into Italy had been allocated on the basis of 1927 figures, giving Germany 70 per cent, France 20 per cent, and Switzerland 10 per cent. The statement originated from Germany.

A communication has now been received from the Aziende Chimiche Nazionali Associate, Milan, the important dye combination in Italy, stating categorically that the Italian industry has not joined the cartel.

The negation does not necessarily affect the allocation of imports mentioned since this agreement was made originally by German, French and Swiss members of the cartel without Italian compliance.

The members of the European dye cartel wish Italian dye manufacturers to agree to abandon any further expansion in the production of vat dyes, leaving this field to the Germans, Swiss, and French. Although vat dyes are not yet produced in Italy on a large scale, the program of Italian producers includes the manufacture of a wider range of vat dyes, and they have expressed themselves as unwilling to accept any clause which will curtail their future development in this field. Italian manufacturers conceded, however, that eventually they may be obliged to reach an understanding with the European dye cartel as the Italian dye industry is unable to meet the cut prices at which members of the cartel sell their dyes on the Italian market.

Foreign Chemical Firm Fails

A report from London states that Chemical Works Johannisthal, formerly owned by Mansfeld Copper Mining Co. and the third largest producer of copper sulphate in Europe, has become insolvent, with liabilities 6,800,000 marks and assets 2,700,000 marks.

A. G. A. Holds Annual Convention and Technical Exhibit

Research and Its Relation to Manufactured Gas Included in Discussions

FUNDAMENTAL economic considerations which determine the proper size and type of gas plant were the most important topic of discussion in the technical sessions of the American Gas Association annual meeting, held October 8 to 12 at Atlantic City. Use of off-peak water-gas capacity for other manufacturing operations, distribution of gas of high pressure over long distances, househeating loads and their effects on invested capital and distribution-system capacity were three of the other important topics considered in economic and engineering reports.

The principal officers of the Association were re-elected for another year's term, Oscar H. Fogg, Consolidated Gas Company of New York, as president; B. J. Mullaney, The Peoples Gas Light and Coke Company, of Chicago, as vice-president; and C. E. Paige, Brooklyn Union Gas Company, as treasurer. The officers elected by the Technical Section of the Association were, Harry E. Bates, of Chicago, as chairman, and B. V. Pfeiffer, of the United Gas Improvement Company, Philadelphia, as vice-chairman.

MOST of the proceedings of the technical section consisted in important committee reports and their supplemental papers and sub-committee contributions. The principal technical committees reporting at the convention were chemical, carbonization, water gas, distribution, pipe joints, and dehydration of gas. Supplemental papers, in some cases presented under the auspices of certain of the technical committees, included a discussion of problems involved in changing from manufactured gas to natural gas service, the use of propane and butane from the petroleum industry for enrichment of manufactured gas, and some considerations required in a preliminary survey of the theoretically correct gas plant. The technical committee reports and these several papers will be reviewed in the November issue of *Chem. and Met.*

Very general interest was evidenced in the subject of research and its relation to the manufactured gas business. Dr. Arthur D. Little served as the principal spokesman on this subject, delivering an address before one of the general sessions on "Research and a Greater Gas Industry." Official reports from the president, the managing director, and the treasurer showed a continued prosperity of the Association financially, further increase in all classes of membership and a very large increase in the magnitude of the industry as measured by sales. Alexander Forward, announcing the official statistics, stated that returns from 1927, now complete, show sales of manufactured and natural gas during that year of 1,854,000,000,000 cu.ft., an increase of 8 per cent over 1926. Revenue from sales was $819,000,000, a gain of $34,000,000 on the preceding year, coming from 15,434,000 customers, who represented 73,000,000 of the population of the United States.

The annual exhibition of gas-making, gas-distributing, and gas-utilization appliances and materials was held under the auspices of the Manufacturers' Section of the Association. A larger number of exhibitors was represented and a larger amount of exhibit space was in use than at any previous convention. The usual social features and general meetings were held, as well as the customary number of sectional meetings.

C. R. Boggs Addresses New York Rubber Section

THE largest and most enthusiastic gathering that ever attended the New York Section of the Rubber Division, American Chemical Society, was present at the first of its fall meetings on October 10 at the Town Hall Club. A delightful dinner preceded the business meeting. The speaker of the evening was Charles R. Boggs, factory manager of the Simplex Wire and Cable Company, and Chairman of the Boston Section of the Rubber Division. Mr. Boggs used as his subject the "Manufacture, technology and testing of rubber-covered, insulated wire," tracing the development from 1887 when the first vulcanized rubber covered wire was produced to the present time when antioxidants, softeners and accelerators are used. He emphasized the importance of the electrical properties of the ingredients of the rubber compounds for insulating wire. The lecture was followed by an active discussion of the subject in which many members took part.

Oil Cracking Process Basis of Lawsuit

ACTION of the Universal Oil Products Company against the Standard Oil Company of Indiana has been resumed under a master, sitting in Washington, D. C. The suit is based on the claim that the defendants, by use of oil cracking processes developed from the Burton method, have infringed the Jesse Dubbs patent of the Universal Company. The Dubbs patent originally covered dehydration of emulsified crude oil but cracking temperatures were used in application of the process. On these and other premises, the plaintiffs are suing for royalties. Desultory legal warfare has been carried on between the companies at intervals for the past several years. Present testimony relates to test runs taken at a specially constructed California plant in 1925 and witnessed by each side.

Germany Plans To Produce Nitrate of Potash

THE Kloeckner Coal & Steel Company of Dortmund and Kali-Industrie Aktiengesellschaft of Kassel (Wintershall), which founded in early 1927 the so-called Gewerkschaft Victor, capitalized at 10,000,000 marks, have progressed so far with plans to produce potassium nitrate that they are now operating an experimental plant at Sondershausen, formerly producing potassium chloride concentrates, and commenced operation during September of a plant at Rauxel, in Westphalia, according to the United States Department of Commerce. Their process involves a Claude high pressure direct ammonia synthesis, separating hydrogen from nearby Kloeckner coke furnaces for synthesis with nitrogen. An ammonia oxidation to nitric acid permits treatment of potassium chloride to yield potassium nitrate.

The latter is, of course, a distinctive commercial fertilizer capable of supplying plant growth with both nitrogen and potash, desirable in Germany for sugar beets and elsewhere for tobacco and tropical crops primarily, on account of its neutral and non-caustic character. An estimate of initial 1929 production by "Victor" places this at 20,000 tons fixed nitrogen in potassium nitrate. This quantity, as in the case of Ruhrchemie's initial annual program, seems absurdly insignificant when compared with a probable annual production by the I. G. at the Leunawerk and at Oppau alone of 600,000 to 650,000 tons nitrogen, but considering its rather unique characteristic (and its use as technical salt), its promoters are optimistic in envisaging a future extension of production, provided, of course, that market demand warrants. Whether "Victor" potassium nitrate will enter the Nitrogen Syndicate, or not, cannot be definitely established as yet.

Search for Raw Materials for Activated Carbon

THE Chemical Warfare Service is continuing, with unabated activity, its search for a domestic material from which a charcoal equal to that obtained from cocoanut shell can be made. While no substitute the equal of cocoanut shell has been developed, it is felt that there are many important commercial applications of the experimental work which the Service has conducted on charcoal. Activated charcoal, practically unknown before the world war, is now used in an important way in commerce, particularly in the extraction of gasoline from actual gas and in the recovery of ether used in powder manufacture.

NEWS FROM WASHINGTON

By Paul Wooton
Washington Correspondent of Chem. & Met.

AN INTENSIVE study of distribution costs is to be made by the chemical specialists of the Department of Commerce. They believe the government is in a position to co-operate actively with the industry and with the trade associations in learning why distribution costs have not been reduced in the same proportion as have the costs of production. There is a tendency to believe that distribution costs would be lower had they been attacked as vigorously as have those of production.

It has been stated authoritatively that half of the concerns engaged in distribution have no accurate information as to their own costs. The Chemical Division will undertake to find out just what percentage of those engaged in the chemical trades really know their costs. It is recognized that accurate cost accounting must be established in order to determine which of the items are excessive. Were costs known more accurately it is believed that there would be less "profitless prosperity."

Information will be sought as to savings that could be effected by relocation. With freight rates forming an increased item of costs, it is known that many plants would be much better off at a location where less would have to be paid the transportation companies. Relocation also might reduce labor costs, warehouse expense and other items of outgo.

IT HAS been charged that trade-marked articles have been increased beyond justification. If the same effort were applied to the marketing of basic products in simpler forms and in finding new uses for them, much of the expense incident to popularizing a multiplicity of trade-marked articles in expensive containers could be avoided to the advantage of the trade and of the consumer, simplification is an important step toward furthering mass production, it is pointed out. Mass production, with its lower costs, cannot be hoped for if basic commodities are unduly refined and marketed in half a dozen forms. No broad survey ever has been made to determine just how accurate such claims are. The Chemical Division hopes to secure very definite information along those lines.

In this effort to help the domestic trade the division expects to arrange for more trade indicators applying to chemical commodities. The monthly summary of current business published by the department presents a picture of the business situation month by month, but deals with few branches of the chemical industry. It is the intention of the Chemical Division to develop as many as possible of such indicators.

Another of the new activities will deal with the gathering of information relative to new uses or the expansion of uses of chemical commodities. It has been the experience of the Department of Commerce that this, as well as most other fact-finding functions, can be carried on best in close co-operation with an agency of the particular group interested. For instance, the Chemical Division did much to encourage the formation of the Pine Institute. Through co-operation with that organization, with the Chlorine Institute or with similar organizations, the division hopes to be able to bring much thought to bear on the subject of new uses. A rather notable piece of work has been done by the department, in co-operation with the Department of Agriculture, on a similar study of new uses of cotton. It is believed just as much definite benefit can be obtained for a considerable number of chemical commodities.

LEGISLATION which will make possible more effective administration of the general Government patent situation will be proposed at the forthcoming session of Congress. The existing Interdepartmental Patents Board has no legislative status and as a result must function as an informal committee representing the departments concerned. Such an agency may not incur expenses or pay compensation in the conduct of its activities. As a result a limited amount of work could be done by the individual members of this Board. At present the board is comprised as follows: Dr. Andrew Stewart, Department of Commerce, chairman; A. R. Cheyney, Post Office Department; Pickens Neagle, Navy Department; Dr. F. G. Cottrell, Department of Agriculture; Col. J. I. McMullen, War Department.

The board was created by an executive order of the President and has formulated regulations covering the handling of government inventions and patents. The legislation necessary to put the recommendations of the Board into effect has been before Congress since 1924, but no action on it has been taken.

The general feeling in the government departments is that some standardized practice should be prescribed for the administration of government patents. There are many questions constantly arising which are difficult to handle because of the uncertainty of the situation. It is their desire that the ideas and accomplishments developed in the government service are to be handled in a way which would be of most service to the public and to industry. To secure patents and to hold them in such a manner as to prevent their use defeats the purpose the departments have in mind.

IT HAS been held by the courts that the government employee has a legal right to take out and exploit a patent or an invention, although he is prevented by law from suing the government for its use of any invention made by the employee while in the government service. He has the privilege of taking out a patent without the payment of the patent office fees, if he agrees to its use by the government without the payment of royalty. Administrative orders have been issued limiting the right of employees to patent and own their inventions but it has been ruled that this in no way lessens the legal rights of the inventor. The right of ownership, however, depends upon the terms of employment. Where it is possible to have an individual and specific contract to cover any invention the employee may make it clear that in such a case the invention must be assigned to the government. In the great bulk of cases, however, the terms of employment are too general to cover specific inventions and in such cases patents taken out by the employee become his own property, subject to use by the government if its time or facilities were involved in the development. There is sufficient uncertainty, therefore, in the absence of a definite contract as to make for an undesirable situation.

In view of that uncertainty the office of the chief co-ordinator in the Bureau of the Budget is expected to keep the question actively before Congress until legislation is secured.

UNDER the decisions of courts, and in line with a policy mapped out by the Department of Justice, producers now are co-operating in a much more definite way than ever before on matters which promote efficiency and effectiveness and which do not conflict with the public interest. There is well pronounced sentiment in favor of certain modifications in the Sherman Act which will allow even further co-operation for the accomplishment of purposes which benefit industry and the people as a whole. The Chemical Division in its new effort to help domestic commerce expects to be able to point out ways in which those engaged in distribution can co-operate in the hope of securing similar desirable ends.

A demand for the basic facts of portland cement chemistry is being filled by extensive research at the Bureau of Standards which is gradually establishing principles heretofore subjects of controversy. These studies are being conducted jointly by the Portland Cement Association and the Department of Commerce under the general supervision of P. H. Bates of the Burerau of Standards and under the direction of R. H. Bogue. A staff of seven men is covering the highly specialized details of the problem as concerns raw materials, manufacture, and use of the product.

France Increases Production of Nitrogen Fertilizers

Modification of Import Agreements May Give Further Impetus to the Industry

From our Paris correspondent

AT THE EIGHTH Congress of Chemical Industry held at Strasbourg in the first weeks of July and attended by over 400 chemists from various countries, nitrogen fertilizers were widely discussed. It is well known that France depends on foreign nitrogen for much of her home wants, Chilean nitrate, Norwegian and German nitrate especially. In 1927 the French consumption in nitrogen fertilizers was as follows: sulphate of ammonia 350,000 tons; nitrate of soda 230,000 tons; cyanamide 57,000 tons; nitrate of lime 37,000 tons; ammonia-hydrochloride 9,300 tons and urea 1,800 tons, bringing up a total of 125,000 tons of nitrogen.

French production of nitrogen fertilizers in 1927 corresponds to 53,000 tons of nitrogen compared with 41,700 tons in 1926, a notable increase, but still inadequate for the home needs as it can only deal with 40 per cent of consumption. It should be noted, however, that in 1913, home consumption was 73,000 tons of nitrogen, the home production being then 17,000 tons only, roughly 25 per cent of the total consumption. These figures plainly show the steady increase of the use of and manufacturing of nitrogen products and fertilizers in France. One of the results of this deficiency in the home nitrogen production is that German synthetic products are allowed to come into France freely as prestation goods supplied under the "Reparation Act." This is laid down in the recent Franco-German agreement and it is a real advantage for the German nitrogen industry. This favored situation will end in January, 1929, and in order to protect the home nitrogen industry several modifications are contemplated.

ALL fertilizers of mineral origin would be taxed at 15 per cent of their value when imported into France, except German fertilizers imported as prestation goods and natural Chilean nitrate; the latter should not exceed, however, 250,000 tons yearly. On the other hand the home industries would not be taxed under the "business activity tax," levied on all first hand sales, but this exception would be applied only to the nitrogen products sold as fertilizers. In fact a protective duty of 18.50 per cent would be thus reached as all fertilizers are now taxed, whether home-produced or imported, on a general basis of 3.50 per cent.

If this protective duty greatly helps the home manufacturers it is a great drawback for importers who state that French consumption could be much larger and that France could easily absorb a bigger quantity of natural or synthetic fertilizers. They quote figures taken from foreign countries showing that fertilizers are used on a far larger scale in neighboring lands.

The present tendency is to make nitrates and not sulphates which are said to decalcify the soil, according to the statements of agriculturists. This product is obtained by the oxidizing of ammonia produced by the catalysis of hydrogen and nitrogen. The process is industrially more profitable than the one comprising the burning of the air nitrogen by the electrical arc, producing nitric acid which requires at least four times as much energy as the former process. These facts explain why the Soulon works in the Pyrenees will henceforth turn its activity towards the manufacturing of composite fertilizers only.

AT THE seventh Economic Conference held in Geneva last year, the unifying of customs' nomenclatures was discussed and a board elected to investigate the matter. Experts have made a report implying that as far as chemical products are concerned the simplifying of tariffs will be no easy matter. It is obvious that the present customs' tariffs are far too complicated, but one does not very well see how the great number of differently taxed products may be reduced, far from it, it is feared their number will still increase owing to the fact that chemical products which until quite recently were only known in research laboratories are now industrial products.

This is particularly true for the intermediary products needed for the manufacturing of coloring matters, the different solvents made for the varnish and lacquers industries and generally speaking all synthetic organic products which are steadily increasing in number.

Scientific circles of the French Academy of Sciences have followed with the keenest interest the experiments made by Messrs. Georges Claude, a member of the Academy, and Paul Boucherot at the Belgian works of Ougrée near Liége to demonstrate the industrial use of the thermic energy of the sea. These two well known scientists have designed a plan, making use of the difference between the temperature of the sea at its surface and in its depths. The experiment consisted in putting water at two different temperatures in two tanks. The difference of the temperature between the two waters (about 18 to 20° C) was sufficient to work a turbine starting a dynamo revolving at 5,000 revolutions per minute and producing an electrical power of 50 kw. It is now thought that a definite plant can be built using the different temperatures of the sea as power. Cuba will probably be the country where the first works of this kind will be built. The greatest difficulty to overcome seems to be the laying of the deep-sea going tube in order to get the necessary low-temperature water.

The explosion of a phosgene tank in the Stolzenberg Works of Hamburg has caused a great deal of comment. The French press particularly wishes to know whether the manufacturing of phosgene is merely reduced to the industrial needs for coloring matters. It is known that European wants do not exceed 500 tons yearly, this product being used in the following chemical industries: organic synthetic perfumes, coloring matters, and pharmaceutical products. The Hamburg tanks contained about 50 tons and this quantity is not abnormal. It is however a big mistake to use 10-ton tanks for phosgene or compressed chlorine. A similar explosion caused by compressed chlorine occurred at the St. Auban Works belonging to the Alais, Froges-Camargue Co. where 23 were killed and 70 injured. The objective conclusion is that only small one-ton tanks should be used for the stocking of dangerous substances. Another result of the Hamburg explosion was that an abandoned stock of war phosgene was discovered in a Swiss factory closed down since the Armistice. The phosgene tanks were immediately sunk in the Geneva lake at a depth of 70 meters. The remaining Hamburg stock was also sunk into the sea.

German Nitrophoska Output Increased This Year

THE GERMAN dye trust has increased production this year of Nitrophoska, the chemically "mixed" nitrogen-phosphoric acid-potash fertilizer, to a probable total of 27,000 tons finished product monthly, Trade Commissioner William T. Daugherty, Berlin, has informed the Department of Commerce. When the head of the Nitrogen Syndicate announced the appearance of Nitrophoska in December, 1926, he indicated an initial monthly production of 10,000 tons; this has been increased since by 170 per cent.

Nitrophoska at Piesteritz is produced by the electro-thermal treatment of phosphate rock over diamonium phosphate. Oppau is using the sulphuric acid method, employing American equipment. Piesteritz has gone over to the standard method of producing phosphorus electrothermally, collecting the phosphorus and burning it to phosphorus pentoxide which it hydrates to phosphoric acid. It is the general impression that Piesteritz operated the Lilienroth furnace last year.

The Oppau method involves employment of the standard sulphuric acid method combined with an American apparatus, consisting of a counter-current decantation system whereby the precipitated calcium sulphate is separated more easily than by filtration.

Liquefaction of Coal To Be Expanded In Germany

Anthracite Plant at Mont Cenis Mine Will Use Bergius Process

From Our Berlin Correspondent

THE MEETING of the gas technologists which took place at Hamburg during the Summer gave some indication of the important progress made through rationalization in the gas industry. Following the report by director Körting on the Gasbetriebsgesellschaft, began a discussion on the types and mixing of coal. The net consumption of coal for 100 cu.m. of gas in this company is now scarcely over 100 kg. as compared with 150 kg. in 1913. Increase in mechanical output and economy in highly-paid labor are the salient factors of rationalization.

In the realm of gas supply, the Braunkohle industry has been especially active. Dir. Karl Schmidt, Halle, found that the question of producing a satisfactory city-gas from brown coal has approached solution, since the technical possibilities of constructing suitable apparatus have now been studied. Laboratory research is stressing purification of CO_2, as well as extraction of sulphur from brown coal. Admixture of gas from brown coal to that from anthracite is wholly possible, according to the studies of Dr. Heinze, Halle.

LIQUEFACTION of coal in Germany, which has arrived at very favorable results with brown coal at the Leunawerke of the I.-G., will very shortly see a further expansion when the first large anthracite plant for the Bergius process is put in operation at the Mont Cenis mine. Outside of Germany, too, such plants are under construction, for example in Hungary. Negotiations are now said to be under way for the exploitation of South African coal resources and for their liquefaction with a view to domestic consumption and supply to neighboring colonies.

The large pipe lines for distant supply of gas in southern Westfalia are to be put in service during October. They are equipped with compressor stations for a pressure of 2 to 5 atmospheres. This pressure is sufficient to feed gas economically to an area within a radius of 100 to 150 km. The quality of the gas has been vastly improved by the construction of the modern coke plants, especially since the large dimensions of these installations allow of mechanical equipment which would be too expensive for small gas plants. Uniformity of gas and a thorough purification are ensured by these large installations.

A new process for coal refining is announced by F. Braunis. By boiling of the coal with water, colloidally fixed water, sulphur, and portions of the ash are removed and the heat value is increased.

The inventor has published (*Montan. Rundschau*, Vienna, 20, 321) a detailed economic evaluation of his process, a thermal calculation of the period of boiling in experimental and plant apparatus, and an illustrated description of this apparatus; basically, then, the process comprises washing of the coal in boiling water.

MEANS for improvement of mineral oil refining are indicated by Prof. Fritz Schwartz. The process involves refining in the presence of soap. Schwartz emphasizes that the impurities in the the distillates do not enter the soap solution but that the soap is precipitated together with the impurities. The originator has compared this precipitation with the sulphuric acid and other processes and has found, especially in the case of transformer oils, that it is characterized by oils of a very slight resin formation.

According to Dittler, Vienna, another advantageous substance in mineral oil refining its "talloel," which is derived as a byproduct in the Scandinavian cellulose industry. By secondary treatment of resinous coniferous wood with caustic of 10 deg. Bé., soaps are obtained from which fatty and resinous acids may be separated by mineral acids. This complex "talloel" is only half as expensive as olein and can be substituted for this or the naphthenic acids under suitable conditions in about the same quantity as olein in order to break emulsions in treating distillates. The most suitable caustic solution is from 3 to 5 deg. Bé. When thoroughly dispersed the mixture is heated indirectly by steam to at least 80 to 85 deg. C. then, after 12 hours' settling the lower solution may be drained off.

FOR the synthesis of rubber, butadiene, dimethylbutadiene, and isoprene are emulsified and then polymerized in the presence of oxygen or oxidizing agents, according to the recently published British patents (283-840 and 283841) of the I. G. Farbenindustrie. Emulsifying agents suggested are soap solutions, albuminous substances, salts of sulphonated fatty acids, saponin, water-oil suspension, and others. To the oxidizing agents it is best to add a little caustic potash. The primary substances suitable for rubber synthesis may also be polymerized in an atmosphere of hydrogen, nitrogen or CO_2, by an alkali metal in the presence of high molecular organic hydroxyl or ether compounds (starch, cellulose, or superficially oxidized rubber). According to reports this new process of the I.G. for rubber synthesis is about to enter the practical stage.

The noxious gases generated in rayon production—hydrogen sulphide and, in bleaching, chlorine—must be carefully removed if ill effects on workers are to be avoided. Since these gases in conjunction with the moisture of the air corrode almost all materials normally employed in handling them and since ceramic ware is expensive and often undesirable because of its ease of fracture, the resinoid substance "Haveg," compounded say with asbestos fibers, is recommended for this purpose. This material has already been used in preference to hard rubber because of its resistance to mechanical stress and its low price.

In the field of fertilizers, the I.G. has lately entered an agreement with the Italian Montecatini group, according to which it will conjunctively erect an ammonium phosphate plant at Cotrone. The necessary phosphoric acid is produced, as hithertofore, by the action of H_2SO_4 on crude phosphate, the pyrolytic method having proved disadvantageous in Italy, it is reported. The lime from the phosphate is converted partly into calcium nitrate; the calcium sulphate content is used for the production of ammonium sulphate.

Two well-known chemical companies have now combined their interests in a merger; they are the J. D. Riedel A.-G., Berlin, and the E. de Haen A.-G., Hannover.

THE name "Masa" has been given to a new jointly established company of the A.E.G. and I.G., which will undertake the production of artificial covering material for substances of all kinds. A new process employed offers the possibility of preparing large surfaces of steel and other fireproof materials, and of expanding their use for doors, walls, cars and vessels. Besides metal, other substances such as wood, pressed pulp, cardboard, and paper can be employed in this treatment. The application of the selected type of wood or marble upon the stock used, is accomplished by hand or machine-operated copper plates or rolls, by a combined low-pressure and off-set printing process.

A method for the cure of carbon monoxide poisoning is reported by L. Schmidt, Kiel. By confining cats, rendered unconscious by CO, in a chamber filled with pure oxygen, in which the pressure oscillated between 2.3 and 2.5 atm. in synchronism with cat's breathing, the specimens were revived in 2 minutes and were removed from the chamber in full health within a half hour.

Production of Synthetic Chemicals Enlarged

The Pennsylvania Salt Manufacturing Co. has announced the recent acquisition of an electrolytic process for the manufacture of pure ammonium persulphate, a mild bleaching, and oxidizing agent.

The National Aniline & Chemical Co. offers synthetic malic acid produced by the catalytic oxidation of benzene to maleic acid, followed by the conversion of maleic to malic acid.

Rounded Exhibition of Equipment Planned for Power Show

World-Wide Interest Shown By Applications for Tickets From Foreign Countries

PROBABLY ONE of the greatest problems to the sales executive of power equipment is that of getting a mental picture of his product before his prospects. The salesman depending on photographs and written descriptions faces a difficult situation in explaining grades, quality and actual demonstration that often accompany visual demonstration.

One of the best answers to such a problem is the Seventh National Exposition of Power and Mechanical Engineering to be held December 3-8, 1928, at the Grand Central Palace during the annual conventions of the American Society of Mechanical Engineers, and the American Society of Refrigerating Engineers. The members of these organizations come from all parts of the world to compare ideas and problems and to visualize the latest developments in power and mechanical engineering achievements.

In no place in the world is there such a collection of engineering ability as is annually assembled for this meeting. Visitors to the Power Show during the past eight years have increased from a few hundred in attendance to a registered visitors' list of twenty-five thousand and a general attendance of one hundred thousand for the week. The careful study given to the five hundred exhibits last year proved conclusively the value of visual demonstration from a sales standpoint. This realization is apparent from the renewals this year by the exhibitors and once more the four floors of the Grand Central Palace will be divided into booths containing the various types of mechanical equipment.

THE importance of such exposition is proven by the fact that of the twenty-five thousand registered visitors over six thousand were officers of corporations or plant owners and sales executives, five thousand were engineers and designers, four thousand four hundred were technical men bent on visualizing the latest achievements that were on display. Some of the large universities include a tour of the exposition in their Student Courses and credit all students for such visits.

This exposition will be the thoroughly rounded exhibition of all manner of mechanical and engineering equipment such as it has been in the past. The power section will include displays of boilers, stokers, grates, oil burners, fans, blowers, pipe, valves, and fittings for single or central station work with instruments of precision and control.

The heating and ventilating exhibit this year is more clearly defined than ever and the development of many new features is expected. The problems of the heating and ventilating engineer have kept pace with the progress in the kindred engineering fields.

This year the exposition will have a particularly interesting exhibit of belting and the related transmissions covering the entire field, the materials handling section with the actual demonstration of various types of industrial trucks, hoists, cranes, winches, conveyors, etc., and the tool and machine tool section with a complete exhibit of lubricants, lubricators, etc.

THIS year the application from foreign countries for tickets and information exceeds by far any past Exposition. One of the most convincing facts is that technical men are evidencing more interest in the show than ever before which is conclusive of the fact that the results obtained have been up to their expectation. A most interesting fact this year has been the number of requests for information and invitations by financial institutions who are beginning to realize that the interest on money invested can only be secured through first-hand knowledge of industry from the engineering side. The financial world realize that without such understanding, invested capital cannot be assured of a return.

The American Society of Mechanical Engineers, the American Society of Refrigerating Engineers, and the American Institute of Chemical Engineers all convene during the Exposition week and visit the show.

News in Brief

A PETITION, charging a violation of the Sherman Anti-Trust Act in the sale of union-made watermarked paper by an alleged monopoly of paper manufactures, was filed on Oct. 1 by the Department of Justice in the United States Court for the Northern District of New York at Albany.

"SCIENTIFIC PAPERS" and "Technologic Papers" of the Bureau of Standards are to be discontinued and all of the scientific and technologic publications from this institution will henceforth appear as articles in the newly established periodical which is to be known as Bureau of Standards Journal of Research.

NEGOTIATIONS are near completion for the merger of nine paint companies with aggregate assets of about $5,500,000. Companies have plants in San Francisco, Seattle, Los Angeles, Portland, Spokane, Tulsa, Youngstown, Milwaukee, and Indiana Harbor. The companies involved include California Paint Co., Hill-Hubbell Co., Jones & Dillingham, Rasmussen & Co., Seattle Paint Co., Magner Brothers Paint Co., Bradley-Wise Paint Co., Brininstool Paint Co., and Technical Oil & Paint Co.

A RESEARCH fellowship for the study of certain problems of the wood distillation industry has just been established at the University of Illinois by the Tennessee Products Corporation of Nashville, Tenn. This work is to be under the direction of Prof. Norman W. Krase. Joseph E. Carlin is chief chemist for the Tennessee Corporation.

MISS ELIZABETH HUMES, assistant trade commissioner at Rome, who is now in the United States, was the guest at a complimentary luncheon held at the Hotel Biltmore October 4 by A. Cressy Morrison, chairman of the Chemical Advisory Committee of the Department of Commerce. A group of approximately twenty executives in chemical and related industries were informed by Miss Humes of the general economic situation, particularly as it affects chemical industry in Italy.

THE FOURTH Pan-Pacific Science Congress will be held in Batavia, Java, May 16 to May 25, 1929, under the auspices of the Netherlands Indies Pacific Research Committee and supported by the patronage of the Netherlands Indies governments according to a communication received by the Department of the Interior from J. H. van Royen, minister at Washington of the Netherlands Government. In the program of the forthcoming conference special emphasis will be laid on agriculture, which is a dominating interest in the Netherlands East Indies.

IT IS REPORTED that agriculturists in New Zealand are interested in the prospects of developing a wood oil industry throughout the upper half of the North Island. A syndicate is being formed and experiments are being conducted over an area of 2,000 acres in the Helensville District, which is understood to be suitable for the growing of the tung tree. There is a sufficient supply of seed on hand for the planting of 1,000 trees, which are to form the nucleus of a nursery for the transplanting of trees.

A SUBSIDIARY company of the French and German Potash Syndicates has been formed in Copenhagen recently with a capital of 500,000 kronen, entirely subscribed by the potash interests for the purpose of selling the fertilizer in Denmark. Denmark imports about 40,000 tons of potash a year and on and from October 1 the whole of this import quantity will be in the hands of the new company. The German Potash Syndicate also is reported to have purchased a patent from the Swedish Nitrogen A. B. The Syndicate will make use of the patent in a new plant.

MEN *in Chemical Engineering*

G. W. WALLACE was recently appointed research engineer of the Hillman Coal & Coke Company, Pittsburgh, but will continue in a consulting capacity for the N. T. U. Company of California.

K. A. FORREST, formerly superintendent of the Camas mill of the Crown Wilamette Paper Company, has been appointed manager of the pulp and paper mill equipment division of the Swenson Evaporator Company.

ALBERT B. NEWMAN, research engineer of the General Electric Company, at the beginning of October undertook his new duties as head of the chemical engineering department of Cooper Union. He succeeds Dr. H. G. Byers who goes to the Bureau of Soils at Washington. Prof. Newman was a graduate in chemical engineering from the University of Michigan in 1911, where he later received his Ph.D. From 1913 to 1915 Prof. Newman was foreman in chemical manufacturing at the National Zinc Company, Kansas City, and was with the American Zinc and Chemical Company, Langeloth, Pa., from 1915 to 1917. The following year he was appointed works manager for the Monsanto Chemical Works and was general manager of the Thermo Chemical Company, St. Louis, from 1920 to 1925.

SOLOMON SCHNEIDER has been transferred from the Navy Yard at Philadelphia, Pa., to chemist in charge of the laboratory attached to the office of the Inspector of Naval Material, U.S.N. at Munhall, Pa.

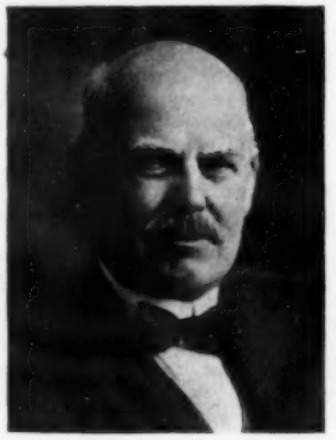
G. H. AUPPERL, connected with the National Roll & Foundry Company as chief chemist and metallurgist for nineteen years, sailed for Japan this summer and is now empoyed there at the Tobatta Foundry Company, Ltd., Kyushu.

JOHN P. SIMONS has become plant engineer of the Industrial Rayon Corporation at Lakewood, Ohio.

ROBERT L. HENDERSON, formerly chief chemist of the Hercules Powder Company, Carthage, Mo., is now assistant acid supervisor of the Grasselli Powder Company, at Seneca, Ill.

EDWARD GOODRICH ACHESON, pioneer in the field of electric furnace products and manufacture, presented a trust fund of $25,000 to the American Electrochemical Society at its 54th annual convention in Charleston, W. Va., on September 21st. This fund will constitute the source of an award, every second year, of a gold medal and a $1,000 prize for a distinguished contribution to one of the branches cultivated by the society.

In addition to the donation's obvious value as an incentive and support to the electrochemical field, there is an eminent fitness in its presentation by Dr. Acheson. Having spent the earliest days of his enterprising and fertile career at Washington, Pa., Dr. Acheson in 1880 began work with Thomas A. Edison and after four years transferred to other laboratories, meanwhile cultivating his native tendency for experiment. It was then in 1891 that he first produced in the electric furnace the new "jewel," carborundum, which so rapidly gained the estate of a universal abrasive. Not long afterward followed another electric furnace product, artificial graphite, which also became of broad utility in a diversity of applications. From this graphite Dr. Acheson developed a third group of products by a new process of colloidal deflocculation, the result being a new series of useful lubricating fluids.



EDWARD G. ACHESON

To the industry and science of which Dr. Acheson has long been such an integral member he now offers a further gratifying expression of support and thanks.

DAVID W. JAYNE has now left the Koppers Company to join the development department of the du Pont organization at Wilmington, Del.

EDWARD J. MEHREN, vice-president and editorial director of the McGraw-Hill Publishing Company, publishers of *Chem. & Met.*, has been appointed editor of the *Magazine of Business.* This paper, which recently came under McGraw-Hill control, will now have available the editorial resources of that organization in its service to the executives and business leaders of the country and it is in this connection that Mr. Mehren's 21 years of editorial, business and engineering background has been enlisted to its leadership. His status as vice-president and editorial director of the company remains unaffected.

WAYNE P. RICE, for the past nine years general superintendent of the Ponca City, Okla., refinery of the Marland Refinery Company, has resigned to accept a similar position with Cosden & Company, Fort Worth. Mr. Rice will have charge of the construction of the refinery which the latter firm is building at Big Spring in Howard County, Texas.

W. E. CLIFFORD, chemical engineer specializing in wood distillation is now employed at the Miner-Edgar Chemical Corporation at Sutton, W. Va.

J. WRENCH, sales manager of the Industrial Chemical Sales Company, returned from an extensive tour of Europe on board the *Scythia* on September 8.

L. L. DAVIS has been appointed general superintendent of the Ponca City, Okla., refinery of the Marland Refining Co., succeeding Wayne P. Rice, who has resigned. Mr. Davis was assistant general superintendent of the refinery. His introduction to the oil industry was with the Crew-Levick company in 1917, and he has been connected with it in several companies ever since.

C. E. PLUMMER has been appointed to the position of chief chemical and metallurgical engineer for the Robert W. Hunt Company, engineers. Mr. Plummer, a graduate of the University of Minnesota, has seen extensive service with various mining and copper companies and was later connected successively with the Bureau of Mines, Bureau of Standards, and Union Carbide & Carbon Research Laboratories.

RICHARD H. DANA, formerly vice-president and treasurer of Hodge and Dana, Inc., is now connected with the Robins Conveying Belt Company, specializing in the engineering and sale of screens.

CALENDAR OF FORTHCOMING EVENTS

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, convention, New York City, Dec. 27, 1928-Jan. 2, 1929.

AMERICAN CERAMICS SOCIETY, 31st annual convention, together with AMERICAN CERAMIC EXPOSITION, Chicago, Feb. 4-9, 1929.

AMERICAN IRON AND STEEL INSTITUTE, 34th general meeting, New York, Oct. 26.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, petroleum division, meeting, Tulsa, Okla., Oct. 18-19.

AMERICAN REFRACTORIES INSTITUTE, fall meeting, Vanderbilt Hotel, New York, Oct. 24.

INTERNATIONAL CONFERENCE ON BITUMINOUS COAL, 2nd conference. Carnegie Institute of Technology, Pittsburgh, Nov. 19-24.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, New York, December 3-8.

NATIONAL FERTILIZER ASSOCIATION, meeting, Atlanta, Ga., Nov. 12-14.

GUSTAV EGLOFF, technical director of the Universal Oil Products Company, arrived here on the *Mauretania* on Oct. 12 after taking part in the World Power Conference at London.

W. T. GRIFFITHS, manager of the research and development department of the Mond Nickel Company, Ltd., came to the United States recently on a business trip, to visit industrial centers and research organizations.

H. D. GRANT was recently made chief engineer of the Swenson Evaporator Company. Mr. Grant graduated from the University of Michigan as a chemical engineer in 1921.

HARRY H. HILL, who has been chief engineer in charge of the Petroleum Division of the Bureau of Mines since July 1, 1925, has resigned to take over the direction of the research work of the Standard Oil Company of New Jersey. He has been in the service of the Bureau since 1913, when he began work as a junior chemist at the Bartlesville station. He rose through the

Harris & Ewing

HARRY H. HILL

grades until he became superintendent and finally chief petroleum engineer for the station. Mr. Hill comes originally from Oklahoma, but was educated at the Universities of Wyoming and of Washington. His associates in the Bureau of Mines tendered him a farewell luncheon on October 11. It is probable that no successor to Mr. Hill will be named until after the first of the year.

WILLIAM L. HAWES, who was chemical engineer at the du Pont Eastern Laboratory, Gibbstown, N. J., has now accepted a post with the Carbide and Carbon Chemicals Corporation, Charleston, W. Va.

H. S. MURPHY, for over three years with the Celanese Corporation of America, has now joined the Industrial Rayon Corporation and will go to the new plant at Covington, Va., next spring.

J. W. GEIB has resigned as assistant superintendent of the Donora Zinc Works, Donora, Pa.

W. C. ADAMS, who has been with the Texas Company at Houston for some time, has been transferred to the manufacturing department with headquarters at New York.

H. T. CLARKE has resigned as chief of the synthetic organic chemicals laboratory for the Eastman Kodak Company to become head of the biochemical department of Columbia University, New York.

WILLIS R. WHITNEY, director of research laboratory of the General Electric Co., has been elected a vice-president of the company.

* * *

OBITUARY

WALTER C. ARTHURS, president of the Mt. Vernon Car Manufacturing Company, Mt. Vernon, Ill., died suddenly on October 7 in his motor car, while returning from his summer home in Minnesota. As a result of his company's new connection with the J. P. Devine Manufacturing Company, Mr. Arthurs had also been chairman of the board of the latter firm.

GEORGE E. HALL, for the past twelve years president and general manager of the Boston Woven Hose & Rubber Company, died from heart trouble at Osterville, Mass., on October 3rd. Mr. Hall was born in Brattleboro, Vt., August 2, 1868. He was formerly connected with the International Paper Company of Watertown, N. Y., and joined the organization of the Boston Woven Hose & Rubber Company in 1907.

DOUGLAS W. FRANCHOT died on September 24 at his sister's home in Muncy, Pa., at the age of 47. A native of Olean, N. Y., and a graduate of Yale, Mr. Franchot engaged in the Oklahoman oil industry in 1904 and was one of the most conspicuous independent operators at the time of his death.

CHARLES J. PECK, who was president of the Detroit Engineering Society, died on September 9 at Highland Park, Mich.

C. KEMBLE BALDWIN, for many years chief engineer of the Robins Conveying Belt Company, died in Los Angeles, Calif., on August 9th. Mr. Baldwin, who graduated from Lehigh University in 1895, soon specialized in the development of belt conveying apparatus and was instrumental in its introduction to new fields of application.

WILLIAM BROS, president of the William Bros Boiler & Manufacturing Company, died at his home near Kimball, Minn., on August 14th. A native of Minnesota, he was born in 1863 and founded his business at Minneapolis in 1901.

JOSEPH A. JEFFREY, chairman of the board of directors and founder of the Jeffrey Manufacturing Company, died at his home in Columbus, Ohio, on August 26 from infirmities. Mr. Jeffrey as early as 1877 saw the great possibilities in mining machinery and soon began in this business as a partner of F. Lechner. It was from this organization that the present company rapidly grew. Mr. Jeffrey was 92 years old at the time of his death.

INDUSTRIAL NOTES

THE VANADIUM CORPORATION OF AMERICA has opened an office at 2245-2246 Henry W. Oliver Building, Pittsburgh, under the direction of J. A. Miller, Jr., general manager of sales of the company.

THE MONSANTO CHEMICAL WORKS, St. Louis, announces the resignation of W. L. Filmer as Chicago district sales manager. He will continue as consultant and special representative, and F. T. Robinson will now be in charge.

THE TIMKEN ROLLER BEARING COMPANY has incorporated a new firm, known as The Timken Steel and Tube Company, which will take over the manufacturing and selling of Timken steel and tubing. The headquarters and mills are in Canton, Ohio, with W. G. Hildorf in charge of all metallurgical work.

THE DEMPSEY FURNACE COMPANY, INC., has been founded by H. B. Dempsey and H. T. Dyer for the design, manufacture and erection of all types of industrial furnaces.

THE DIAMOND ALKALI COMPANY, Pittsburgh, Pa., through F. G. Lancaster, has announced that beginning this fall liquid chlorine in all the standard types of containers will be added to its present line of industrial chemicals.

E. I. DU PONT DE NEMOURS COMPANY has acquired through purchase the alum plant owned and operated by the North Hudson Chemical Company, located at Albany, N. Y. The DuPont Company will continue to operate the plant and maintain sales offices at Albany.

THE PERBERT SCHORNDORFER COMPANY, of Cleveland, manufacturing and selling paints, varnishes, enamels, and lacquers, has absorbed the Lankin Vivian Company, paint and varnish manufacturers

THE WAGNER ELECTRIC CORPORATION announces that Fred Johnson, heretofore in charge of the Wagner Electric St. Louis sales office, is now manager of the Los Angeles branch office.

FOOTE BROS. GEAR & MACHINE COMPANY announce that they have recently appointed A. H. Tischer, 704 No. Alabama St., Indianapolis, Ind., to represent them in that territory.

BOTFIELD REFRACTORIES COMPANY, Philadelphia, Pa., has appointed W. E. Tierney as its representative in the South and Southwest, with headquarters in New Orleans.

INTERNATIONAL COMBUSTION ENGINEERING CORPORATION has made one of the most important acquisitions in the history of the company in the purchase of the Hedges-Walsh Weidner Company, of Chattanooga, Tennessee.

THE LINCOLN ELECTRIC COMPANY of Cleveland, Ohio, announces the opening of a San Francisco office at 533 Market Street in charge of W. S. Stewart.

THE SPRAY ENGINEERING COMPANY, formerly at 60 High Street, Boston, Mass., has moved its office to its factory, the address now being 114 Central Street, Somerville, Mass.

THE INTERNATIONAL OXYGEN COMPANY of Newark, N. J., has taken over the business of the Tariffville Oxygen and Chemical Company of Tariffville, Conn. This plant will be conducted by a newly formed company, The Tariffville Oxygen Company as the New England division of the International Oxygen Company.

THE BASSICK MANUFACTURING COMPANY has changed its name to Alemite Manufacturing Corporation. The address remains 2650 No. Crawford Ave., Chicago, Ill.

THE CHASE BRASS & COPPER COMPANY, INC., announces that all products hitherto sold by the Waterbury Manufacturing Company and the U. T. Ungerford Brass & Copper Co., will henceforth appear under the Chase name and with the Chase mark.

WISHNICK-TUMPEER, INC., through its subsidiary, Century Carbon Company, has purchased the natural gas holdings of the Consumers Gas Company, of Louisiana.

THE ATLAS CONVEYOR COMPANY, INC., Philadelphia, announce that A. J. Forschner, who joined the company in July as vice-president, has also taken over the duties of secretary for the company.

THE FALK CORPORATION announces the appointment of B. W. Rogers, 225 Central Savings & Trust Building, Akron, Ohio, as representative for Akron and environs.

THE ATLAS PORTLAND CEMENT COMPANY has completed plans for the immediate construction of a plant near Waco, Texas, with an initial annual production of approximately one million barrels per year, this being the first Atlas plant in that State.

PFALTZ & BAUER, INC., 300 Pearl Street, New York, American representatives, announce that the firm of E. de Haen A. G., Seelze, Hanover, Germany, has combined with the firm of J. D. Riedel A. G. and will be known in future as J. D. Riedel-E. de Haen, A. G.

MARKET CONDITIONS *and* PRICE TRENDS

Large Production of Superphosphate In First Nine Months

Increase in Supplies Leads to Fears of Heavy Surplus Stocks

RECENT reports of production, shipment, and stocks of superphosphate issued by the National Fertilizer Association have led to considerable fear that the increase in supplies this year above previous production may result in an unusual surplus. Responsible men in the industry are taking the stand that the normal growth of superphosphate business is approximately 10 per cent per year. They therefore argue that the increase of 20.7 per cent over the median average of the past four years and of 31.4 per cent for the first nine months of 1928 as compared with the corresponding period last year represents a dangerous increase in output.

This conclusion is particularly significant in view of the fact that fertilizer tag sales in the principal states have declined somewhat in recent months as compared with like months last year. With increasing production of superphosphate and decline in tag sales highly uneconomic stock-on-hand is forecast unless corrective measures ensue between now and the opening of the season foc active fertilizer demand for spring planting.

PRODUCTION of bulk superphosphate during the first six months of the current year, as reported to the Department of Commerce by 80 concerns operating 172 plants, was 2,261,476 tons, as compared with 2,018,804 tons during the preceding six months, and 1,680,775 tons during the first six months of 1927. Statistics covering production, shipments, and stocks of superphosphate and sulphuric acid, reported by superphosphate manufacturers, will be found in the accompanying table.

Fertilizer tag sales for September showed a decline of 36.6 per cent as compared with the corresponding month of 1927. However, this loss in buying movement is not indicative of the present status of the fertilizer industry as it is improbable that sales of fertilizer over the remainder of the year will fall off in anything like the proportion reported for September. In the southern states which are the largest consumers of fertilizer, the outlook has improved owing to the recovery in market prices for cotton official estimates on the yield of the present cotton crop have been revised downward but there still is a difference of opinion regarding the final outturn. When this question has been settled definitely, values for cotton will carry more confidence and more concrete ideas may be formed relative to future demands for fertilizer in the South.

WHILE its influence is not so immediate, members of the fertilizer industry are interested in the future effects of enlarged nitrogen production. In reviewing the situation the secretary of the National Fertilizer Association recently wrote that for the nitrogen year that ended June 30, 1928, the output from natural, by-product and synthetic sources, excluding organic materials, was about 1,600,000 short tons. In other words, the production has far more than doubled since the beginning of the World War in 1914. . . . In view of the world development of synthetic plants, particularly as the desire for military independence overrides economic considerations, it seems that the deposits of nitrate in Chile will become less and less important, a fact that should be given due weight in considering the surplus production now confronting the world. If the Chilean production merely holds its own and the manufacture of by-product sulphate of ammonia increases only at a very moderate rate, the plants now in operation and under construction will probably have a productive capacity of no less than 2,000,000 tons of pure nitrogen by 1930. As the world consumption in the nitrogen year just ended was 1,400,000 tons compared with a production of 1,600,000 tons, the problem of disposing of an annual product of 2,000,000 tons will soon involve sharp competition and no doubt insufficient price returns. As was true of the rest of the world, the production of by-product nitrogen in the United States has increased apace. In 1913 we produced 195,000 net tons. Last year production of sulphate of ammonia was approximately 715,000 tons. In 1913 we did not produce a pound of synthetic nitrogen, and in 1921 we produced only 200 tons. Now our annual productive capacity has risen to more than 30,000 tons. Before the end of 1928 this capacity will probably be increased to 60,000 tons and in less than two years it will be double this amount. Hence a surplus supply of nitrogen is in prospect.

Production of Bulk Superphosphates

	1928	1927	
	First Half Jan.–June	2nd Half July–Dec.	First Half Jan.–June
United States			
Production:			
Bulk superphosphate	2,261,476	2,018,804	1,680,775
Base and mixed goods	582,592	(1)	(1)
Shipments to consumers, dealers, etc.	970,661	743,518	1,172,395
Stocks: end of period			
Bulk superphosphate	931,753	1,345,971	1,050,886
Base and mixed goods	308,431	706,931	197,012
Southern District (2)			
Production			
Bulk superphosphate	1,123,818	1,027,143	803,676
Base and mixed goods	167,872	(1)	(1)
Shipments to consumers, dealers, etc.	518,829	260,027	632,874
Stocks: end of period			
Bulk superphosphate	510,651	882,714	652,571
Base and mixed goods	85,964	463,257	57,089
Northern District			
Production:			
Bulk superphosphate	1,137,658	991,661	877,099
Base and mixed goods	414,720	(1)	(1)
Shipments to consumers, dealers, etc.	451,832	483,491	539,521
Stocks: end of period			
Bulk superphosphate	421,102	414,254	397,315
Base and mixed goods	222,467	292,677	139,923

(1) Not available.
(2) South of the Virginia-North Carolina line projected westward.

Production of Sulphuric Acid by Superphosphate Manufacturers

	1928	1927	
	First Half Jan.–June	2nd Half July–Dec.	First Half Jan.–June
United States			
Produced in establishments reporting	943,832	877,792	779,079
Consumption in making fertilizers, including shipments to other fertilizer manufacturers	1,142,535	1,166,040	971,089
Shipments to other than fertilizer manufacturers	102,409	70,793	82,217
Stocks at end of period	88,626	93,171	89,727

MARKET APPRAISAL OF CHEMICAL INDUSTRY

An order for five 80,000-barrel steel storage tanks has been placed by Magnolia Petroleum Co. (Standard Oil of New York) for erection on its tank farm at Midland, Texas. Completion of the new tankage will give the company a total of 41 55,000-bbl. and 80 80,000-bbl. steel tanks in the west Texas area.

Statement of Air Reduction Co., Inc., reported to New York Stock Exchange, for six months ended June 30, 1928, shows net income of $1,378,305 after depreciation, amortization, interest and federal taxes, equivalent to $2.04 a share earned on 676,203 no-par shares of stock.

Report of Industrial Rayon Corp. and subsidiaries, filed with New York Stock Exchange, for eight months ended August 31, 1928, shows net profit of $960,338 after depreciation, interest and federal taxes, equivalent to $7.38 a share earned on 130,050 no par shares of stock outstanding on that date. Based on average of 120,906 shares outstanding during July and August earnings for these two months were equal to $2.31 a share, which added to $7.15 a share on 95,215 shares outstanding June 30, gives eight months average of $9.46 a share on stock.

Liquid Carbonic Company stockholders will vote December 6 on a proposal to increase capital stock from 200,000 to 400,000 shares of no par common. The company now has 125,000 shares outstanding. The increase proposed by the company is to provide for expansion and other pending developments.

Proposed increase by Atlantic Refining Co. of its common stock to 4,000,000 shares of $25 par value from 500,000 shares of $100 par, if adopted by stockholders, will place the company in a position to inaugurate a program of expansion. While nothing official has been announced, it appears likely that part of the additional stock will be used for acquisition of properties or interests in other oil units.

Kelly-Springfield Tire Co. has called a special meeting to vote on a plan to increase authorized common stock from 400,000 shares of $25 par to 1,200,000 no par shares. Directors have approved plan whereby stockholders will receive one share of no par common stock for each share of $25 par stock and be given the right to subscribe pro rata to an additional 700,000 shares of common stock at $21 a share.

Price Range Since Jan. 1 High	Low	Stock	Price Range in September — Sept. 1	High	Low	Sept. 29
86⅛	59	Air Reduction	79	82½	76	80
14⅛	7½	Ajax Rubber Co.	8⅛	10½	8	10
234⅛	146	Allied Chemical	199½	201	192½	201
125½	120½	Allied Chemical, pf	122½	123	121⅛	121½
23½	15⅛	Am. Ag. Chemical	19½	22½	19	19
76½	55⅛	Am. Ag. Chemical, pf	71	74½	67	67
53½	30½	American Cyanamid, B	37½	37⅛	33	34½
15⅛	9⅛	Am. Hide & Leather	10	11½	10	10
135	56⅛	American Linseed	121½	135	110½	116
....	86½	American Linseed, pf	120	128	123½	124
53⅛	39	American Metals	49½	53⅛	47⅛	51
24	13	Am. Rayon Products	17	22	17	19
28½	11⅛	Am. Solvents & Chemical	21	22⅛	20⅛	21⅛
54	26½	Anglo-Chile Nitrate	42	45	30½	42⅛
97	55½	Archer-Daniels-Midland	79½	82½	77⅛	79½
33⅛	26½	Ass. Dyeing & Printing	28½	30	26½	29½
101	63	Atlas Powder	80½	82½	80	81
20½	12½	Beacon Oil	16⅛	19⅛	16	18⅛
83½	70⅛	Beechnut Packing	78½	80	75½	76½
78½	65½	Bon Ami, A	73½	77	72½	72½
86	65	Bristol-Myers	73	85	72½	82
36	24	Calif. Petroleum	31½	36	31½	35
103	53½	Celanese Corp	....	68⅛	57	63
185½	115	Celanese Corp., pf	128	131	118	....
63½	37½	Certainteed	45½	46½	39	40½
56½	45½	Chickasha Cotton Oil	50½	53	48⅛	52
224	137½	Commercial Solvents, B	177	221½	175	211
89⅛	64⅛	Corn Products	82½	89⅛	82½	84½
66⅛	34⅛	Davison Chemical	55½	66⅛	55½	61½
61	40	Devoe & Raynolds	53½	57½	52	54
....	....	Devoe & Raynolds, pf	114½	115	112	113
405½	310	Du Pont	391½	401½	383	400
121½	114	Du Pont 6 pc. db	....	....	....	....
194½	163	Eastman Kodak	184⅛	184⅛	187	178½
238	165½	Firestone Tire	175	179½	171	....
17⅜	8⅛	Fisk Rubber	12½	12½	10½	10⅜
88½	65	Fleischman	75⅛	88	73½	85⅛
109½	53⅛	Freeport Texas	62⅛	72½	56½	58⅛
30	20⅛	Glidden	26⅞	29⅛	25	28⅛
105	95	Glidden, pf	103	105	102½	104
110⅞	71	Gold Dust	103½	110⅞	96	101½
99⅛	68½	Goodrich Co	81⅛	86½	77⅛	84½
167	119	Houston Oil	142½	149½	138½	141½
143	78½	Industrial Rayon	83½	143	83½	133½
20⅞	13	Int. Ag. Chemical	15⅛	17½	15½	15½
83½	48⅛	Int. Ag. Chemical, pf	77½	83½	77½	77½
86⅛	66	International Paper	70	72½	66½	70⅛
....	....	International Salt	54½	59½	54½	58
27⅛	15	Kelley-Springfield	18⅛	26½	18⅛	25½
26½	17½	Lee Rubber & Tire	20⅛	21½	19	20⅛
64½	38	Lehn & Fink	54⅛	63⅛	54	62½
158½	109	Libby-Owens	....	152	129⅛	152
84½	63½	Liquid Carbonic	74½	84½	74½	78⅛
148½	117⅛	Mathieson Alkali	145	148½	136½	142½
....	....	Monsanto Chemical	....	....	....	....
58½	29½	Nat'l. Dist. Products	44⅛	44⅛	40½	42½
....	....	National Lead	125½	131½	123½	123½
260	180½	New Jersey Zinc	....	243	215	....
68½	58½	Ohio Oil	62	63⅞	61½	62½
95½	74½	Owens Bottle	83½	83½	77⅛	80½
....	....	Palmolive Peet	....	....	....	....
45	35½	Phillips Petroleum	39½	45	39½	42½
300	210	Pittsburgh Plate Glass	....	300	255	....
....	....	Pratt & Lambert	56½	60	56½	60
300	217	Procter & Gamble	....	288½	272	....
27½	19	Pure Oil	23⅛	26	23⅛	24
....	....	Sherwin-Williams	....	92	80½	....
....	....	Silica Gel	23½	24⅛	20½	23⅛
32½	17⅛	Sinclair Oil	25⅛	32½	25½	30⅛
36½	25	Skelly Oil	30⅛	36½	29½	35⅛
63⅞	53	Standard Oil, Cal.	58⅛	61⅞	58⅛	61½
49	37⅜	Standard Oil, N. J.	44⅛	47⅛	44½	45⅛
41½	28⅛	Standard Oil, N. Y.	35½	37½	35½	35⅛
40	10	Standard Plate Glass	3⅛	5½	3⅛	5⅛
59½	31½	Sun Oil	53½	59½	53½	55
....	....	Swan & Finch	....	....	....	....
17½	10½	Tenn. Copper & Chemical	14⅛	17½	14	15⅞
72⅛	50	Texas Corp.	62⅛	72⅛	62½	67⅛
80⅛	62½	Texas Gulf Sulphur	73½	74⅛	69½	71
36	19⅛	Tidewater Oil	20½	25	20½	21⅛
630	450	Tubize Silk	544	549	485½	494½
194	136½	Union Carbide	172⅛	194	167	188½
57	42⅛	Union Oil, Cal.	50½	52⅞	49½	51
95	52½	United Piece Dye	89½	91½	85	....
131⅛	102½	U. S. Ind. Alcohol	124	129	118	129½
51	22	U. S. Leather	45⅞	46½	38½	39½
63½	27	U. S. Rubber	39½	43½	36½	38½
87⅞	72	Vacuum Oil	80½	84	79½	82½
96	60	Vanadium Corp	77	88½	76½	81
78⅞	58	Vick Chemical	74⅞	77⅛	71½	72½
16½	12	Va. Ca. Chemical	13½	15⅞	13½	14⅛
55½	44½	Va. Ca. Chemical, pf	49½	53⅛	49½	52½
87	67	Wesson Oil	74	82½	73	81½
16	11	Wilson & Co.	13⅛	13⅛	12½	13

ECONOMIC INFLUENCES *on production and consumption of* CHEMICALS

Consuming Industries Require Larger Output of Chemicals

Manufacturing Operations Promise to Surpass Those of Last Year

MANUFACTURING plants of the nation closed the third quarter of the year with operations at the highest rate ever recorded by American industry in general, based on consumption of electrical energy. Reports received by *Electrical World* on monthly consumption of electricity by 3,600 manufacturing plants indicate that the rate of operations in these plants in September was 11.4 per cent greater than that for August, and 13.5 per cent above the rate for September last year. The figure for September, corrected for the number of working days, was 5.4 per cent above the previous high rate of activity established in February of the current year.

The average rate of operations in the manufacturing plants in the first nine months of the year was 5.3 per cent greater than that for the same period in 1927. This is about 2 per cent higher than the generally accepted normal rate of annual growth in American productive activities.

ALL the national primary manufacturing groups, with the exception of lumber and its products and the textile industry, reported a rate of operations for September over that of last year. The automotive industry, including the manufacture of parts for replacement, led all other groups with a gain of 47 per cent contrasted with the September, 1927, rate. The ferrous and non-ferrous metal working plants showed a gain over September of last year of 37.2 per cent; rubber and its products, 32.2 per cent; rolling mills and steel plants, 28.8 per cent; stone, clay and glass, 28.7 per cent, and food and kindred products, 11.4 per cent.

The textile plants, taken as a whole, increased their rate of operations by 15.7 per cent in September over August, but were still about 7.2 per cent below September of last year. In lumber the September figures disclosed a drop in the rate of operations as compared with the preceding month, as well as a decline from the September level of last year.

All sections of the country except the South closed the third quarter with general manufacturing operations on a higher plane than in September last year. The New England States reported a gain of 1.2 per cent, the Middle Atlantic States 14.5 per cent, the North Central States 28.5 per cent and the Western States 6 per cent. In the South the rate of operations for September was 6.7 per cent lower than a year ago.

At the meeting of the Atlantic States Shippers Advisory Board, held on Oct. 4, reports were received regarding the cars which would be required to transport commodities within that section during the final quarter of this year. Reports were submitted for thirty commodities or commodity groups. Of these, twenty-one indicate that shipments for the quarter will show increases, ranging from 3 per cent to 47 per cent, as compared with those for the corresponding period of last year. Decreases were indicated in the case of nine commodity groups. The net change in the movement of all commodities was estimated at 6 per cent more than was the case in the last quarter of 1927. As the movement of commodities, into and out of producing centers, is practically in direct proportion to production, these reports may be regarded as authority for the statement that manufacturing activities in the Atlantic States will be 6 per cent larger than they were in the October-December period of 1927. Because of the inclusive nature of the raw materials and finished products which are included in these reports, it is logical to deduce that conditions, as reported for the Atlantic States, will hold good for the country at large.

REFERRING these reports more particularly to the industries which have a bearing on production and consumption of chemicals, it is found that increased operations are indicated for the remainder of the year. Production of chemicals, measured in terms of shipments, is placed at an advance, ranging from 3½ to 7½ per cent, over that for the final quarter of last year. For the same period and on the same comparison, production of clay and clay products will show a decline of less than 1 per cent; fertilizer and fertilizer materials, a gain of 47 per cent; tanning materials, a loss of 9 per cent; lime, a decline of 4 to 5 per cent; petroleum and petroleum products, an increase of 10 to 13 per cent; paper and pulp, a gain of 13 per cent; glass containers are expected to be produced in about the same quantity as in the final quarter of last year, which will represent a loss of about 9 per cent as compared with the third quarter of this year, the result of seasonal conditions.

Reports regarding activity in the textile industry vary according to the different branches, but in the main they are favorable. The linoleum and oil cloth industries promise to surpass their outputs of last year and building operations are favorable for a large consumption of chemicals and oils. The extent to which chemical production depends upon automobile manufacture, places more than ordinary importance on statements that automotive operations will continue on a large scale.

POSSIBILITIES in the export trade in chemicals and related products may be inferred from the interest foreign countries have shown so far this year. The latest official figures for the export trade are for the month of August. For the eight months ended August, chemicals and related products were shipped abroad to the value of $92,045,155 as compared with $90,402,406 in the corresponding period of last year.

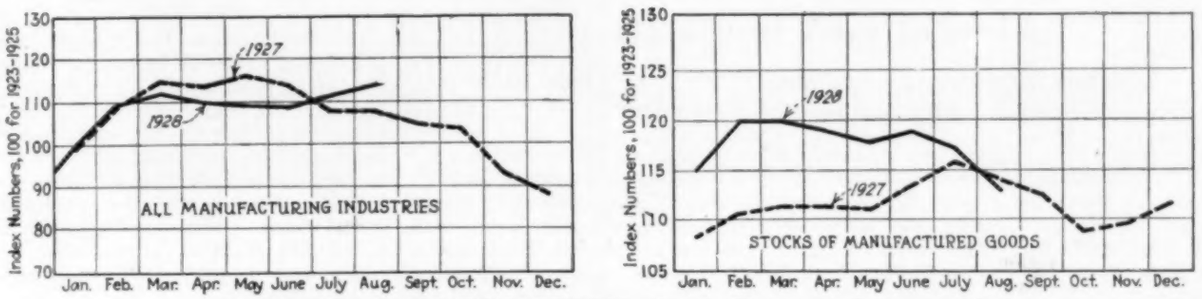
Coal-tar chemicals make an unfavorable showing for the period and undoubtedly will close the year with a poorer record than that established in 1927. The industrial chemical specialty group, on the other hand, has materially exceeded, in quantity and value, the totals reported last year. Industrial chemicals also have entered foreign commerce in larger volume. Sodium compounds have made a particularly good showing with sodium borate making the largest gains.

The outward movement of pigments, paints, and varnishes has recorded an increase of about 17 per cent in value over exports in the eight-month period of 1927. Fertilizer and fertilizer materials offer an unfavorable comparison with last year, principally because of reduction in shipments of sulphate of ammonia.

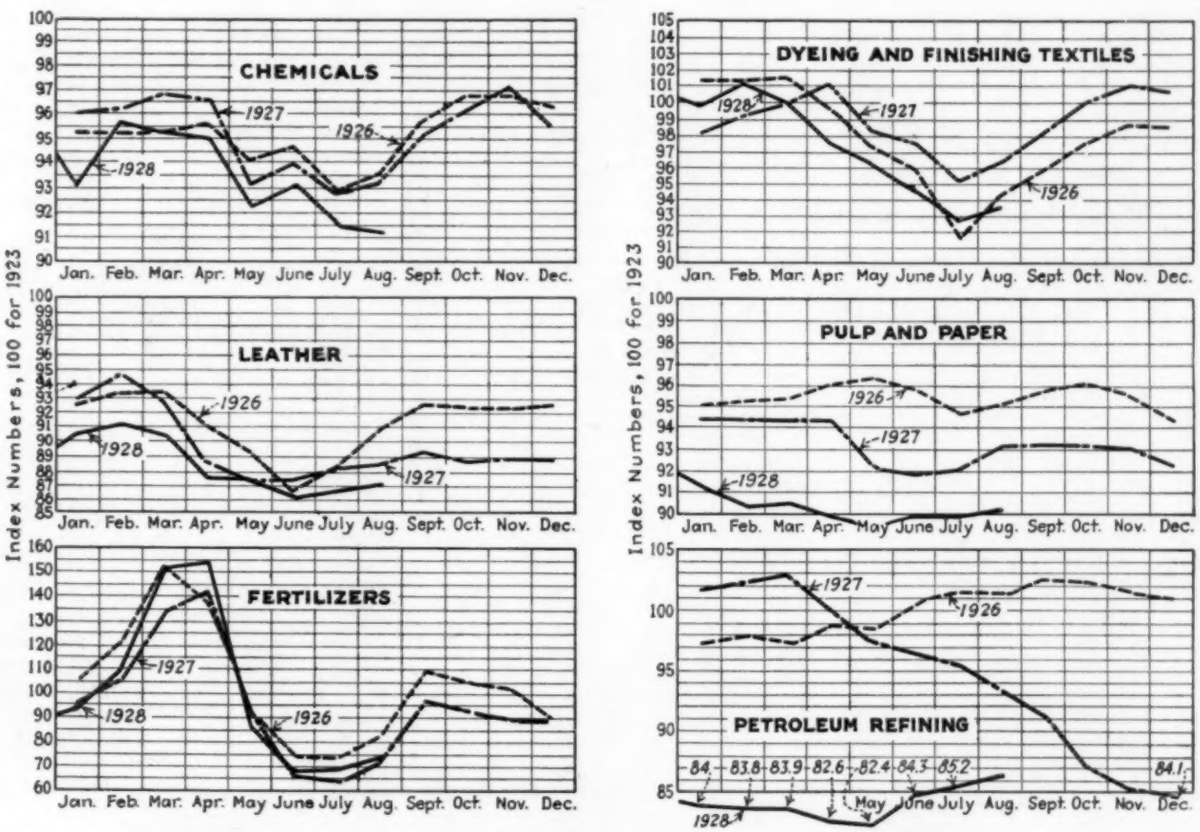
COMPETITION from imported materials has an influence upon domestic production. It naturally follows that when competing chemicals of foreign origin come into this country in large volume they have a depressing effect upon domestic production. Reference to import statistics reveals that our import trade is tending toward the elimination of competing chemicals. However, raw materials which are necessary to the manufacture of chemicals and which are not native to this country, are being imported in larger volume.

Official returns for the eight months ended August give the value of chemicals and related products, imported into this country, at $99,475,696 as against $86,049,444 for the similar period of 1927.

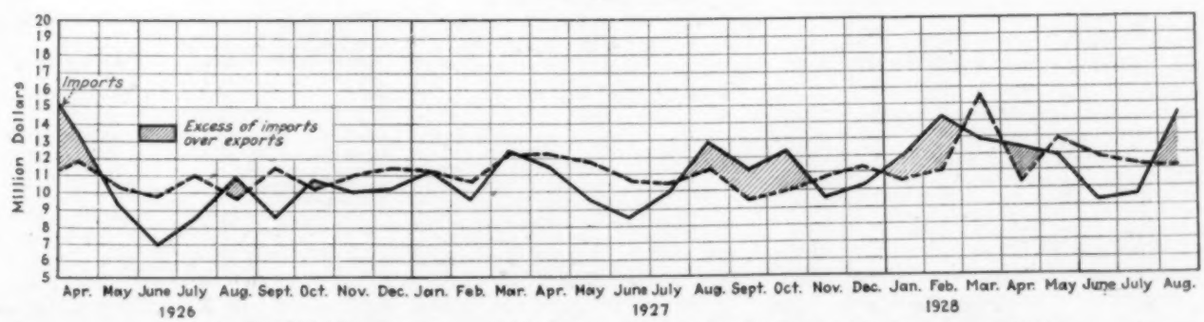
INDEXES OF ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES



VOLUME OF PRODUCTION *(U. S. Dept. of Commerce)*



FACTORY EMPLOYMENT *(U. S. Dept. of Labor)*


Million Dollars
Imports
Excess of imports over exports
Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug.
1926
1927
1928

FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS

MARKET CONDITIONS *and* PRICE TRENDS

Increased Trading Extends Throughout Market for Chemicals

Contract Placements Combined With Spot Demand Responsible for Buying Movement

GENERALLY satisfactory conditions in manufacturing industries, may be assigned for the present good demand for raw materials. During the last month most of the industries which are consumers of chemicals have increased productive activities and this has resulted in a large call for chemicals. While the falling off in production during the hot-weather period was less pronounced than usual this year, it had some effect on the movement of chemicals. In the last month, consumers have given shipping directions more freely for deliveries against contract commitments. Trading in the spot market, likewise, has assumed larger proportions. The buying movement has been noticeably stimulated by the willingness of producers to accept orders for future deliveries of many chemicals. In some cases, new contract orders are reported to have exceeded in volume those placed at this time a year ago. New contract prices have not yet been fixed for some of the important chemicals and active contracting is expected when quotations are announced for alkalies and chlorine.

Among developments which are regarded as having market significance, are the steps which are underway to enlarge domestic production of phosphoric acid. It is reported that a plant is under construction which will have an annual capacity of 386,000,000 lb. Should production increase in anything like that degree, there would be a large surplus which could hardly be marketed unless it was absorbed by the fertilizer industry.

The recent increase in quotations for methanol, acetic acid, acetone, and formaldehyde has called attention to the strong position of those markets. In some quarters, crude methanol is little better than nominal in price because of the sold up position. Acetic acid, also, is in limited supply although the glacial grade has been offered by producers who are turning out a synthetic product. Barium chloride is another chemical for which demand has overtaken production and at present producers are finding it difficult to take care of existing orders.

The September estimate of area sown to flaxseed in Argentina for the 1928-29 season is 7,389,000 acres or 4.7 per cent above last year's final estimate of 7,055,000 acres, according to the United States Bureau of Agricultural Economics. Decreases are reported for the United States and Canada compared with last year, however, so that the total acreage for 1928 in 13 countries so far reported is only 2.1 per cent above the area reported for the same countries in 1927. Reports from Argentina continue favorable and present prospects point to a good crop in that country. The outlook in North America based on September 1 conditions indicated a crop 3,859,000 bushels below the 1927 production. A decrease of 12 per cent is expected in the United States compared with last year, while Canada reports a decrease of 14 per cent.

MANUFACTURERS of industrial alcohol express themselves as well satisfied with present and future conditions in the industry. The third-quarter bulletin of the Industrial Alcohol Institute, whose membership manufactures 97 per cent of the commercial alcohol produced in the United States, shows sharply marked sales increases with a corresponding decline in on-hand stocks as compared with the same period in 1927 and preceding years.

Endorsement and recommendation of denatured alcohol as an anti-freeze radiator solution by over 50 per cent of the automotive manufacturers during 1928 has greatly increased pre-winter orders for that purpose. In past years these sales have averaged 30,000,000 gal. The outlook for 1928-9 indicates a larger consumption.

OF GENERAL interest in trade circles was an announcement made early in the month to the effect that a code of ethics governing future activities in the cottonseed oil mills industry, presented by that industry, has received the approval of the Federal Trade Commission. This follows closely a demand to the commission and the Department of Justice, emanating from various points in the cotton belt, for an investigation of an alleged trade agreement to hold down the price paid the cotton farmer for his seed.

It was declared to be unfair competition to discriminate in the prices paid to different sellers of cotton seed or the prices charged for the products thereof when the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly. It was resolved that each mill publish prices paid for cotton seed and prices received for the products thereof, and that the reporting of false or fictitious prices, or the failure to report the exact price paid for cotton seed, or prices received for the products thereof, is unfair competition.

Production of Caustic Soda in Japan

ACCORDING to Dr. S. Ochi, of the Tokyo Imperial Industrial Laboratory, total production of caustic soda in Japan in 1927 was 55,146,738 lb. of which 39,503,320 lb. was produced by electrolytic methods and 15,643,418 lb. by the causticising of soda ash. Total imports during the year were 90,993,866 lb. and as exports amounted to 120,246 lb., the caustic soda consumption of Japan for 1927 is estimated at 146,020,340 lb.

The actual amount of chlorine made in Japan in 1927 is not known, but the total productive capacity of the twelve plants is estimated at 110,000 lb. a day; 96 per cent of the total chlorine produced is utilized in the form of bleaching powder and less than 1 per cent is liquefied. The Japanese production, export and consumption of bleaching powder in 1927 was as follows: production (estimated), 85,219,519 lb.; export, 5,750,265 lb.; consumption, 79,469,254 lb.

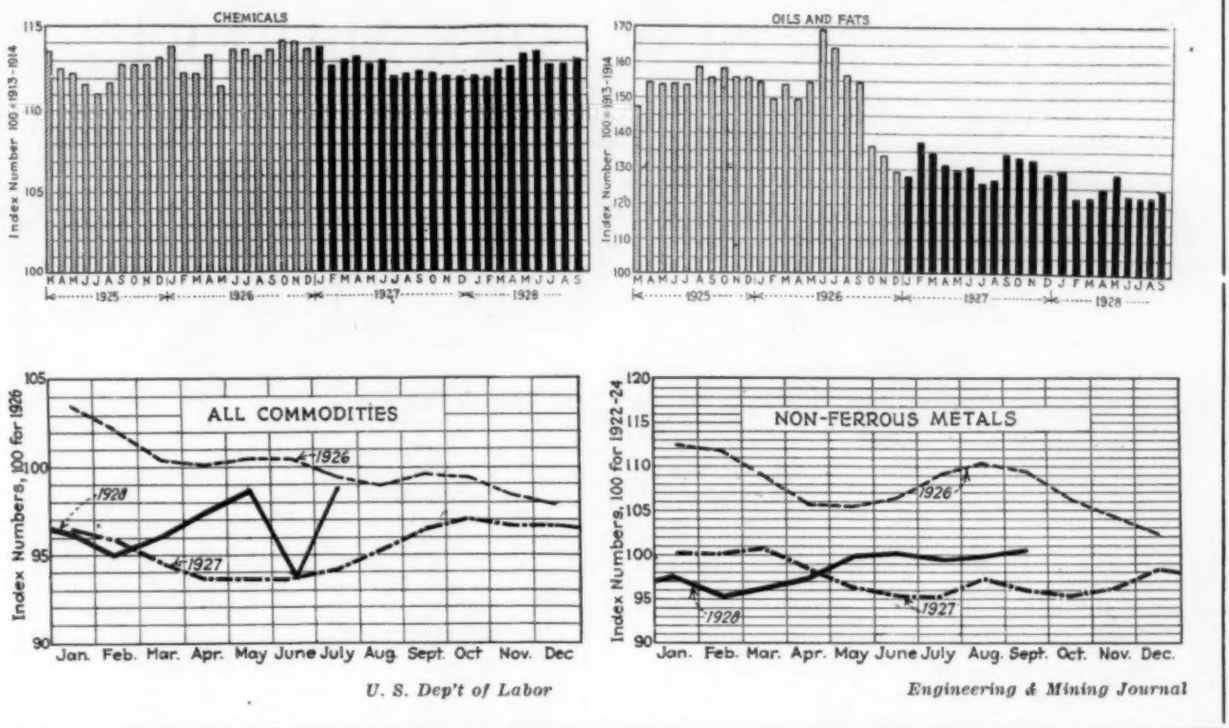
Imports of Chemicals

	August 1927	August 1928
Dead or creosote oil, gal.	8,340,107	9,901,790
Pyridine, lb.	.....	17,369
Coal-tar acids, lb.	8,526	208,825
Coal-tar intermediates, lb.	100,622	107,621
Arsenic, white, lb.	2,209,977	702,670
Acid, citric, lb.	.....	21,200
Acid, formic, lb.	131,373	100,147
Acid, oxalic, lb.	145,121	75,578
Acid, sulphuric, lb.	1,882,760	2,520,865
Acid, tartaric, lb.	174,496	282,240
Ammonium chloride, lb.	757,148	541,301
Ammonium nitrate, lb.	871,633	1,319,189
Barium compounds, lb.	640,794	851,234
Calcium carbide, lb.	52,000	372,000
Cobalt oxide, lb.	13,050	39,035
Copper sulphate, lb.	46,237	601,990
Bleaching powder, lb.	123,740	163,512
Glycerine, crude, lb.	2,036,247	21,420
Glycerine, ref., lb.	803,866	143,346
Iodine, crude, lb.	89,273	46,056
Magnesium compounds, lb.	2,457,746	1,359,605
Potassium cyanide, lb.	2,536	21,661
Potassium carbonate, lb.	1,158,790	1,284,441
Caustic potash, lb.	1,273,523	1,044,587
Cream of tartar, lb.	5,600	30,239
Potassium chlorate, lb.	1,042,791	1,079,988
Sodium cyanide, lb.	2,727,468	3,600,504
Sodium ferrocyanide, lb.	226,921	113,587
Sodium nitrite, lb.	11,014	11,684
Sodium nitrate, ton	71,904	75,318
Sulphate of ammonia, ton	521	219

Exports of Chemicals

	August 1927	August 1928
Benzol, gal.	1,783,216	2,706,276
Acid, acetic, lb.	.....	22,798
Acid, sulphuric, lb.	517,474	291,035
Other acids, lb.	856,280	856,818
Methanol, gal.	18,796	14,000
Glycerine, lb.	25,837	138,517
Formaldehyde, lb.	47,720	183,135
Ammonium compounds, lb.	307,288	84,122
Aluminum sulphate, lb.	3,850,770	3,549,023
Acetate of lime, lb.	282,650	1,141,308
Calcium carbide, lb.	273,415	548,345
Bleaching powder, lb.	2,260,430	1,648,462
Copper sulphate, lb.	375,462	524,433
Potassium compounds, lb.	222,441	266,542
Sodium bichromate, lb.	466,807	537,412
Sodium cyanide, lb.	71,583	105,362
Borax, lb.	6,948,731	8,013,167
Sodium carbonate, lb.	5,019,904	6,959,275
Sodium silicate, lb.	5,391,993	6,128,712
Caustic soda, lb.	5,540,275	10,505,167
Sodium bicarbonate, lb.	1,498,929	1,291,499
Sulphate of ammonia, ton	7,024	8,569
Sulphur, ton	88,032	55,404

CHEM. & MET. *Weighted Indexes of* PRICES



U. S. Dep't of Labor *Engineering & Mining Journal*

Firm Price Tone Underlies Trading in Majority of Chemicals

CONSUMING industries are showing interest in expected announcements which will establish contract prices for important chemicals covering deliveries throughout 1929. Producers of some chemicals already have named prices for future delivery and are reported to have booked a large volume of business. This is exemplified in the case of bichromates. Both the soda and potash products are offered for 1929 delivery at the price levels which have recently been quoted. There is the usual price range on a quantity basis with many large consumers said to have covered requirements.

New price schedules for alkalies and chlorine have not yet been made public. In the present year there has been more or less instability to quotations for caustic soda. This has led to the belief that some readjustment may be made in contract quotations for caustic soda and chlorine. As production of liquid chlorine promises to be enlarged in the coming year, it is regarded in some quarters that a lower price schedule will be made effective for future positions. This not only would serve to discourage an overproduction of chlorine but smaller returns on sales of chlorine would reduce the margin between producing and sales costs of caustic soda and thus work for closer adherence to prices as quoted for the latter.

WHILE efforts are being made to increase production of wood distillation chemicals, offerings are not large to bring about any weakening in values and current prices are expected to be maintained over the remainder of the year. Synthetic methanol is underselling the wood product, but this is not weakening the price tone of the latter.

Salt cake, which has been under selling pressure for some months, is showing signs of recovery. Sales are still going through considerably under the levels quoted a year ago, but production of niter cake is reported to be decreasing and a larger consuming market for salt cake is anticipated on that account.

Alcohol has followed a rising price trend in recent months and stocks in producers' hands are declining. Sales for anti-freeze account are reported to have involved large volumes for future delivery. The statistical position of the market, therefore, is favorable for the maintenance of present values. In addition to controlled production, manufacturing costs may become a bullish factor on prices for distant deliveries.

Latest estimates on the domestic outturn of cotton has been a decided factor in steadying values for vegetable oils and fats. While a crop of close to 14,000,000 bales of cotton is indicated, this represents a reduction from earlier estimates. As a result, the downward price trend for cottonseed oil was checked. Vegetable oils which come into competition with cottonseed oil have been directly affected. Tallow, likewise, has held a stronger course. A material advance, therefore, has been found in the weighted index number for oils and fats during the last month. The situation has become more complicated because of higher markets abroad for oriental oils.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.09**
Last month	113.02
October, 1927	112.39
October, 1926	114.17

Strength in wood distillation chemicals continued to feature the market. Coal-tars generally were steady in price. Smaller stocks of niter cake reduced selling pressure in salt cake. Prussiates were marked up and the index number showed a slight gain for the month.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**124.39**
Last month	121.02
October, 1927	133.77
October, 1926	135.71

Reduced estimate for the cotton crop had bullish effect on crude cottonseed oil. Linseed oil moved up with the flaxseed market. Oriental oils were influenced by firmness in primary markets. Tallow was more strongly held and the general market for oils and fats was higher than a month ago.

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to October 15.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.14 -$0.15	$0.14 -$0.15	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.62½- 3.87½	3.62½- 3.87½	3.38 - 3.63
Boric, bbl.	lb.	.06½- .07	.06½- .07	.08½- .08½
Citric, kegs	lb.	.46 - .47	.46 - .47	.44½- .45
Formic, bbl.	lb.	.11 - .12	.11 - .12	.11 - .12
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.12 - .12½	.12 - .12½	.13½- .14
22%, tech., light, bbl.	lb.	.05½- .06	.05½- .06	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks	ton	11.00 -11.50	11.00 -11.50	10.50 -11.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.38 - .38½	.38 - .38½	.37 - .37½
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl.	gal.	2.68½- 2.71	2.68½- 2.71	3.75 - 4.00
Alcohol, Butyl, dr.	lb.	.18½- .19	.18½- .19	.19½- .20
Denatured, 190 proof				
No. 1 special dr.	gal.	.47 -	.47 -	.48 -
No. 5, 188 proof, dr.	gal.	.47 -	.47 -	.48 -
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl.	lb.	.02½- .03½	.02½- .03½	.02½- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03½- .04	.03½- .04	.02½- .03
Ammonia, anhydrous, cyl.	lb.	.13½-	.13½-	.11 - .13
Ammonium carbonate, powd. tech., casks	lb.	.12 - .13	.12 - .13	.10½- .14
Sulphate, wks.	cwt.	2.40 -	2.40 -	2.25 -
Amylacetate tech., drums	gal.	1.75 - 2.00	1.75 - 2.00	2.15 - 2.20
Antimony Oxide, bbl.	lb.	.10½- .10½	.12 - .12½	.16 - .16½
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs	lb.	.09 - .10	.09 - .10	.09½- .10
Barium carbonate, bbl.	ton	57.50 -60.00	57.50 -60.00	52.00 -54.00
Chloride, bbl.	ton	63.00 -70.00	63.00 -70.00	62.00 -62.00
Nitrate, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl.	lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.02½- .03	.02½- .03	.04½- .04½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	4.00 -	3.50 -	3.50 -
Arsenate, dr.	lb.	.06½- .07	.06½- .07	.07 - .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	20.00 -	20.00 -	21.00 -
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05 - .06	.05 - .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03½- .04½	.03½- .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	16.00 -17.00	16.00- 17.00	14.00 -17.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .17½	.16½- .17
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.30 - 5.50	5.30 - 5.50	5.00 - 5.10
Cream of tartar, bbl.	lb	.27½- .28	.27½- .28	.27½- .28
Diethylene glycol, dr.	lb.	.10 - .15	.10 - .15	- -
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, drums	gal.	.82 - .84	.82 - .84	.74 - .76
Formaldehyde, 40%, bbl.	lb.	.08½- .09	.08½- .09	.08½- .09
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.40 - 1.50
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra	lb.	.14 - .15	.14 - .15	.23 - .24
Lead:				
White, basic carbonate, dry, casks	lb.	.08½-	.08½-	.09 -
White, basic sulphate, sck.	lb.	.07½-	.07½-	.08½-
Red, dry, sck.	lb.	.09½-	.09½-	.09½-
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.13 - .13½	.13 - .13½
Lead arsenate, powd., bbl.	lb.	.13 - .14	.13 - .14	.12 - .13
Lime, chem., bulk	ton	8.50 -	8.50 -	8.50 -
Litharge, pwd., csk.	lb.	.08½-	.08½-	.08½-
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.06½- .07	.06½- .07	.07½- .08
Methanol, 95%, dr.	gal.	.55 -	.55 -	.53 -
97%, dr.	gal.	.55 -	.55 -	.55 -
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.10 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10½- .11½
Orange mineral, csk.	lb.	$0.11½-	$0.11½-	$0.11½-
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.62 - .65
Yellow, cases	lb.	.32 - .33	.32 - .34	.32 - .33
Potassium bichromate, casks	lb.	.08½- .08½	.08½- .08½	.08½- .08½
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd.	lb.	.06½- .07	.06½- .07	.08½- .09
Cyanide, cs.	lb.	.52 - .55	.51 - .53	.55 - .57
First sorts, csk.	lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide(c'stic potash) dr.	lb.	.07½- .07½	.07½- .07½	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -	36.40 -	36.40 -
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.15 - .16	.15 - .16	.14 - .15
Prussiate, yellow, casks	lb.	.18 - .19	.17½- .19	.18½- .19
Sal ammoniac, white, casks	lb.	.047- .05	.047- .05	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	14.00 -17.00	14.00 -17.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -	1.32 -	1.32½-
Dense, bags	cwt.	1.35 -	1.35 -	1.37½-
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	2.80 - 3.00	3.00 - 3.10
Acetate, works, bbl.	lb.	.05½- .06	.05½- .06½	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.07 - .07½	.07 - .07½	.06½- .06½
Bisulphate, bulk	ton	3.00 - 3.50	3.00 - 3.50	5.00 - 5.50
Bisulphite, bbl.	lb.	.03½- .03½	.03½- .03½	.03½- .04
Chlorate, kegs	lb.	.05½- .06	.05½- .06	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl.	lb.	.08½- .09½	.08½- .09½	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Nitrate, bags	cwt.	2.15 -	2.15 -	2.32½-
Nitrite, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Phosphate, dibasic, bbl.	lb.	.03 - .03½	.03 - .03½	.03½- .03½
Prussiate, yel. drums	lb.	.11½- .12	.11 - .12	.12 - .12½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.02½- .03½	.02½- .03	.03½- .04
Sulphite, crys., bbl.	lb.	.02½- .03	.02½- .03	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.09 - .09½	.08½- .09
Sulphur, crude at mine, bulk	ton	18.00 -	18.00 -	18.00 -
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.15½-	.14½-	.17½-
Oxide, bbl.	lb.	.54 -	.53 -	.64 -
Crystals, bbl.	lb.	.37½-	.37 -	.42 -
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10 - .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.08½- .09	.08½- .09	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-	.06½-	.06½-
5% lead sulphate, bags	lb.	.06½-	.06½-	.06½-
Sulphate, bbl.	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.12½-$0.13	$0.12½-$0.13	$0.13 -$0.13½
Chinawood oil, bbl.	lb.	.15½-	.14½-	.15 -
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-	.08½-	.08½-
Corn oil crude, tanks, (f.o.b. mill)	lb.	.08½-	.08½-	.10 -
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½-	.08 -	.09½-
Linseed oil, raw, car lots, bbl.	lb.	.102-	.096-	.101 -
Palm, Lagos, casks	lb.	.09 -	.08 -	.07½-
Niger, casks	lb.	.08½-	.07½-	.07½-
Palm Kernel, bbl.	lb.	.09½-	.09½-	.09 -
Peanut oil, crude, tanks(mill)	lb.	.10 -	.09½-	.10 -
Rapeseed oil, refined, bbl.	gal.	.88 - .90	.88 - .90	.85 - .86
Soya bean tank (f.o.b. Coast)	lb.	.09½-	.09½-	.09½-
Sulphur (olive foots), bbl.	lb.	.10½-	.10½-	.09½-
Cod, Newfoundland, bbl.	gal.	.65 - .67	.65 - .67	.63 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .61	.60 - .61	.60 - .62
Crude, tanks(f.o.b. factory)	gal.	.42½-	.41 -	.46 -
Whale, crude, tanks	gal.	.73 -	.73 -	-
Grease, yellow, loose	lb.	.07½-	.07½-	.06½-
Oleo stearine	lb.	.10½-	.10½-	.12½-
Red oil, distilled, d.p. bbl.	lb.	.09½- .09½	.09½- .09½	.09½- .09½
Tallow, extra, loose	lb.	.08½-	.08½-	.08 -

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.15 - .16	.15 - .16
Aniline salts, bbl.	lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

		Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl.	lb.	.70 - .72	.70 - .75	.70 - .72
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.58 - .60	.58 - .60
Benzyl chloride, tech, dr.	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.22 - .23	.22 - .23	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks	gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr.	lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl.	lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl.	lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr.	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.45 - .47	.45 - .47	.45 - .47
H-acid, bbl.	lb.	.63 - .65	.63 - .65	.63 - .65
Naphthalene, flake, bbl.	lb.	.05 - .06	.05 - .06	.04½ - .05
Nitrobenzene, dr.	lb.	.08½ - .10	.08½ - .10	.09 - .10
Para-nitraniline, bbl.	lb.	.52 - .53	.52 - .53	.52 - .53
Para-nitrotoluine, bbl.	lb.	.28 - .32	.28 - .32	.28 - .32
Phenol, U.S.P., drums	lb.	.13½ - .14	.15 - .17	.18 - .19
Picric acid, bbl.	lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr.	lb.	1.35 - 1.50	1.35 - 1.50	3.00 - .....
R-salt, bbl.	lb.	.47 - .50	.47 - .50	.47 - .50
Resorcinal, tech, kegs.	lb.	1.30 - 1.35	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl.	lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w., tanks	gal.	.35 -	.35 -	.35 - .....
Tolidine, bbl.	lb.	.95 - .95	.95 - .96	.95 - .96
Toluene, tanks, works	gal.	.35 -	.35 -	.35 - .....
Xylene, com., tanks	gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.	lb.	.16½ - .17	.16½ - .17	.17½ - .18
China clay, dom., f.o.b. mine	ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.07¼ - .08	.07½ - .08	.06½ - .07
Prussian blue, bbl.	lb.	.31 - .33	.31 - .33	.33 - .34
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.27 - .31	.27 - .30	.27 - .30
Carmine red, tins	lb.	5 25 - 5 50	5.25 - 5.50	5.50 - 5 75
Para toner	lb.	.60 - 70	.60 - .70	.80 - .90
Vermilion, English, bbl.	lb.	1.80 - 1.85	1.80 - 1.85	1.80 - 1.85
Chrome yellow, C. P., bbl.	lb.	.15½ - .16	.15½ - .16	.17 - .18
Feldspar, No. 1 (f.o.b. N. C.)	ton	5.75 - 7.00	5.75 - 7.00	5.75 - 7.00
Graphite, Ceylon, lump, bbl.	lb.	.08 - .08½	.08 - .08½	.08 - .09
Gum copal, Congo, bags	lb.	.07½ - .08	.07½ - .08	.09½ - .10
Manila, bags	lb.	.15 - .18	.15 - .16	.15 - .18
Damar, Batavia, cases	lb.	.22 - .23	.22 - .23	.25 - .25
Kauri, No. 1 cases	lb.	.48 - .53	.48 - .53	.55 - .57
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	40.00 -	40.00 -	44.00 - .....
Pumice stone, lump, bbl.	lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H	bbl.	9.55 -	9.35 -	9.10 - .....
Turpentine	gal.	.53½ -	.51½ -	.54 - .....
Shellac, orange, fine, bags	lb.	.61 -	.61 -	.52 - .53
Bleached, bonedry, bags	lb.	.60 - .66	.60 - .66	.59 - .61
T. N. bags	lb.	.47 - .48	.47 - .48	.48 - .49
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.)	ton	9.50 -	9.50 -	10.50 - .....
300 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.)	ton	13.75 -	13.75 -	13.75 - .....
Wax, Bayberry, bbl.	lb.	$0.31 -$0.32	$0.31 -$0.32	$0.22 -$0.26
Beeswax, ref., light	lb.	.41 - .42	41 - .42	43 - .45
Candelilla, bags	lb.	.23 - .24	23 - 24	.27 - .28
Carnauba, No. 1, bags	lb.	.46 - .48	.50 - .51	.62 - .63
Paraffine, crude				
105-110 m.p.	lb	.04¾ - .05	.04¾ - .05	05½ - .06

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-	$200.00-	$200.00- .....
Ferromanganese, 78-82%	ton	105 00-	105 00-	90 00- .....
Spiegeleisen, 19-21%	ton	33 00-	32 00-	33.00-35.00
Ferrosilicon, 14-17%	ton	45 00-	45 00-	.....
Ferrotungsten, 70-80%	lb.	.95- .98	.95- .98	.95- .98
Ferro-uranium, 35-50%	lb.	4 50-	4.50-	4.50- .....
Ferrovanadium, 30-40%	lb.	3 15- 3.75	3.15- 3 75	3.15- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.15½-	$0.14½ -	$0.13½- .....
Aluminum, 96-99%	lb.	.24 - .26	.24 - .26	.26 - .28
Antimony, Chin. and Jap.	lb.	.11¼-	.09¼-	.12 - .....
Nickel, 99%	lb.	.35 -	.33 -	.35 - .....
Monel metal, blocks	lb.	.28 -	.28 - .28	.32 - .33
Tin, 5-ton lots, Straits	lb.	.49 -	49 -	57¼- .....
Lead, New York, spot	lb.	6 50 -	6.20 -	6 25 - .....
Zinc, New York, spot	lb.	6.60 -	6.60 -	6.45 - .....
Silver, commercial	oz.	58¼-	59 -	.57¼- .....
Cadmium	lb.	.70 - .80	.60 -	60 - .....
Bismuth, ton lots	lb.	1 70 -	1.85 - 2.00	1 85 - 2.10
Cobalt	lb.	2.50 -	2.50 -	2.50 - .....
Magnesium, ingots, 99%	lb.	.85 - 1.10	98 -	75 - .80
Platinum, ref.	oz.	76 00- 76.50	76 00- 76.50	72 00- .....
Palladium, ref.	oz.	42.00- 46.00	46 00- 49.00	53 00-54.00
Mercury, flask	75 lb.	128.00-	122.50-	127 00- .....
Tungsten powder	lb.	1.10- 1 15	1.05-	1 05- .....

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8 75
Chrome ore, c.f. post	ton	21.00- 23 00	22.00- 24.00	22 00- 23 00
Coke, fdry., f.o.b. ovens	ton	2 85- 3 00	2 85- 3.00	3 25- 3.75
Fluorspar, gravel, f.o.b. Ill.	ton	17.00- 18.00	16.00-	17.00- .....
Ilmenite, 52% TiO_2, Va.	lb.	.00¾ - .00¾	.00¾- .00¾	.00¾- .....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.36 - .38	.36 - .38	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.48 - .50	.48 - .50	.48- .50
Monazite, 6% of ThO_2	ton	130.00-	130.00-	120.00- .....
Pyrites, Span. fines, c.i.f.	unit	.13 -	.13 -	.13½- .....
Rutile, 94-96% TiO_2	lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over	unit	11.25 -11.50	10.50 -10.75	11.25 -11.50
Vanadium ore, per lb. V_2O_5	lb.	nom.	nom.	.25 - .28
Zircon, 99%	lb.	.03 - ...	.03 - ...	.03 - .....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Aluminum, Paint, Enamel, Etc.—A. L. Flint, General Purchasing Officer of Panama Canal, Washington, D. C., will receive bids until Oct. 31 for powdered aluminum, drop black paint, metallic brown, black and white enamel, chrome green, liquid paint drier, dry red lead, white lead in oil, linseed oil, putty, spar varnish, etc.

Bottling Plant—Houston Coca Cola Bottling Works, 1210 Washington St., Houston, Tex., had plans prepared for a 2 story, 107 x 120 ft. bottling plant on Capitol St. Estimated cost $80,000. Bringle & Smith, Atlanta, Ga., are architects.

Brass Factory—The Royal Brass Mfg. Co., 1420 East 43rd St., Cleveland, O., awarded contract for a 1 story, 34 x 132 ft. factory at 1424 East 43rd St. to Super-Built Construction Co., 1836 Euclid Ave., Cleveland, O. Estimated cost $40,000.

Brass Foundry—Baker Perkins Co. Inc., Hess Ave., Saginaw, Mich., is having plans prepared for a 1 story, 100 x 230 ft. addition to foundry. Private plans. Machinery and equipment for brass foundry department, etc., will be required.

Brass Foundry—M. S. Little Mfg. Co., 151 New Park Ave., Hartford, Conn., awarded contract for a 1 story, 50 x 120 ft. brass foundry to Bartlett-Brainard Co., 252 Asylum St., Hartford, Conn. Estimated cost $40,000.

Brick Plant — Bridgeport Brick Co., Bridgeport, Tex., have acquired a 41 acre site at Goose Creek and plans extensions and improvements to plant including kilns, etc. Estimated cost $40,000. Private plans.

Brick and Tile Plant—Clayburn Co. Ltd., 850 Hastings St. W., Vancouver, B. C., plans extensions and improvements to brick and tile plant, including new kilns, etc., at Kilgard, B. C. Estimated cost $350,000.

Candy Factory—Sperry Candy Co., 140 Reed St., Milwaukee, Wis., plans the construction of a 5 story, 50 x 140 ft. candy factory on Pittsburgh Ave. C. Thoringer, Milwaukee, Wis., is architect.

Cement Plant — Atlas Portland Cement Co., 25 Broadway, New York, N. Y., plans the construction of a cement plant, 1,000,000 bbls. annual capacity at Waco, Tex. Estimated cost $2,000,000. Work will be done under the supervision of company engineers.

Cement Plant—Commonwealth Portland Cement Co., L. L. Griffiths, Pres., Room 1100 58 Pine St., New York, N. Y., Faxon-Bowen, North Adams, Mass., Agts., had plans prepared for the construction of a cement plant at Pownal, Vt. Estimated cost $1,000,000. Private plans.

Cement Plant—Pacific Coast Cement Co., 3801 East Marginal Way, Seattle, Wash., awarded contract for a 3 story, 70 x 80 ft. cement plant to Pacific Coast Engineering Co., 811 Railroad St. S., Seattle, Wash. Estimated cost $170,000.

Cement Plant—Republic Portland Cement Co., W. M. Thornton, Mgr., c/o Smith Bros. Properties, Inc., 121 Villita St., San Antonio, Tex., will build a cement plant at Longhorn, Tex. Estimated cost $200,000. Terrell Bartlett Engrs., Calcasieu Bldg., San Antonio, Tex., are engineers. F. E. Sayers, in charge.

Cement and Paving Material Plant — Monolithic Portland Gulf Co., Port Aransas, Tex., will soon receive bids for the construction of a cement and paving material plant. Estimated cost $2,500,000. Private plans.

Chemical Plant—W. Lynn Chemical Co., North Davidson St., Indianapolis, Ind., awarded contract for a 3 story, 35 x 100 ft. chemical plant, to A. A. Fitchell Co., 247 North Lansing St., Indianapolis, Ind. Estimated cost $46,000.

Chemical Plant — McKesson & Robbins Co., Grasmere St., Fairfield, Conn., is receiving bids for the construction of a 5 story, 100 x 200 ft. chemical plant on Grasmere St. Estimated cost $155,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archt.

Chemical Plant—Stauffer Chemical Co., Rives-Strong Bldg., Los Angeles, Calif., had plans prepared for the construction of a chemical plant including 60 x 150 ft. caustic soda building, 75 x 75 ft. acid plant, caustic soda and acid tanks, 2,000 ton capacity, etc. on Wilmington Ave. Estimated cost $750,000. Private plans.

Color Products Plant — General Color Products Co., 1220 Webster Ave., Chicago, Ill., awarded contract for the construction

of a 1 story plant for the manufacture of acid-resisting and weatherproof colors for all kinds of metals, glass, china and pottery ware at 2106-14 North Natchez Ave., to Austin Co., 510 North Dearborn St., Chicago, Ill.

Compress Plant — Texas Warehouse & Compress Co., Floydada, Tex., plans the construction of a compress plant. Estimated cost $75,000. Machinery and equipment will be required. Work will be done by owners forces.

Confectionery Supplies, Etc.—Fargo Food Products Co., P. J. Martin, Secy., 301 Front St., Fargo, N. D., awarded contract for a 3 story, 50 x 100 ft. factory for the manufacture of bakery, hotel and confectionery supplies at 8th St. and 5th Ave. N. to T. F. Powers & Co., 419 8th St. N. Fargo, N. D. Estimated cost $60,000.

Cork and Seal Factory — Crown Cork & Seal Co., Baltimore, Md., will soon award contract for a 1 and 2 story, 150 x 600 ft. addition to factory. L. W. White, Hearst Tower, Baltimore, Md., is architect.

Fertilizer Plant—Davison-Pick Fertilizer Co., Gretna, La., is having plans prepared for extensions and improvements to plant to increase the capacity to 45,000,000 ton annually. Estimated cost $150,000. Equipment including mixing machines, etc. will be required.

Fumigation Plant — California Cotton Mills, J. H. Miller, Gen. Mgr., Cotton and Railroad Aves., Oakland, Calif., plans the construction of a 1 story fumigation plant on Berry St., San Francisco, Calif. Architect not selected.

Gas Plant—Cities Service Gas Co., 60 Wall St., New York, N. Y., plans extensions and improvements to natural gas plants at Mooreland and Pampa, Tex., to increase the capacity. Estimated cost $40,000 and $40,000 respectively. Machinery and equipment will be required.

Gas Plant — Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y., Engr., is constructing a new Steere carbureted water gas plant to consist of a 5 ft. water gas machine, fuel handling system, tubular condenser, after coolers, pumps, purifier, piping and other auxiliary equipment to serve Tuscumbia and Sheffield, Ala. Soft coal will be used for generator fuel.

Gas Plant—Stamford Gas & Electric Co., 11-17 Bank St., Stamford, Conn., awarded contract for the construction of a complete water gas plant to Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.

Gas Plant Expansion—Minneapolis Gas Light Co., 16 South 7th St., Minneapolis, Minn., c/o F. T. Hulswit, 120 Broadway, New York, plans to expend $5,000,000 to $10,000,000 for extensions and improvements of gas plants, mains, etc., at Minneapolis, Minn.

Gasoline Plant — Forest E. Gilmore Co., Amarillo, Tex., plans the construction of a casinghead gasoline plant, 20,000 gal. capacity near Pampa, Tex. Estimated cost $200,000. Private plans.

Gasoline Plant—Phillips Petroleum Co., Bartlesville, Okla., will build a gasoline plant near Crane, Tex., by day labor. Estimated cost $100,000. Private plans. Work will be done under the supervision of company superintendent.

Incandescent Lamp Plant — Brinkerhoff Electric Co., New York, N. Y., plans the construction of a 2 story, 70 x 180 ft. plant for the manufacture of incandescent lamps at West New York, N. J. Estimated cost $200,000. Lockwood, Greene, 100 East 42nd St., New York, N. Y., are engineers.

Laboratory—Bell Telephone Laboratories Inc. of New York, 463 Lexington Ave., New York, awarded contract for the construction of a 3 story, 50 x 120 ft. laboratory building at Bank and Washington Sts. to Turner Construction Co., 420 Lexington Ave., New York, N. Y.

Laboratory—Belluche Photo Finishing Service Co., 786 Massachusetts Ave., Cambridge, Mass., is receiving bids for a 1 story laboratory building, etc. on Franklin St. Estimated cost $40,000. Private plans.

Laboratory—Dept. of Mental Hygiene, Capitol, Albany, N. Y., awarded contract for the construction of a laboratory and mortuary building at Kings Park State Hospital, Kings Park, N. Y., to John A. Blom, 8485 159th St., Jamaica, L. I., N. Y. Estimated cost $33,930.

Laboratories, etc.—Constructing Quartermaster, Picatinny Arsenal, N. J., will receive bids until Nov. 7, for the construction of an administration building, thirteen buildings for laboratory area, twenty-one buildings for melting loading area and three buildings for shop area.

Laboratory—Dept. of Public Works, Ottawa, Ont., will receive bids until Oct. 21 for the construction of a pyro-metallurgical laboratory on Booth St. Estimated cost $20,000. T. W. Fuller, c/o Dept. of Public Works, is architect.

Laboratory — Locke Insulator Corp., Charles and Cromewil Sts., Baltimore, Md., will build a 2 story, 73 x 115 ft. laboratory. Estimated cost $40,000.

Laboratory—Port of New York Authority, 75 West St., New York, N. Y., is having sketches made for a 4 story, 50 x 100 ft. laboratory at Side Ave. Fox Pl. and West St., Jersey City, N. J. Estimated cost $250,000. Private plans.

Laboratory (Chemical)—E. F. Houghton Co., 240 West Somerset St., Philadelphia, Pa., awarded contract for a 3 story, 30 x 60 ft. chemical laboratory to Farrell-Roth Co., 213 South 46th St.

Laboratories (Chemistry and Physics)—Bd. of Education, P. McCallum, Chn., Windsor, Ont., awarded contract for a 2 and 3 story high school including chemistry and physics laboratories, etc. at Jockey Club Park to G. H. Emery Co., Dowler Bldg., Windsor. Estimated cost $700,000.

Laboratories (Chemistry and Physics)—Bd. of Education, A. N. Hill, Chn., Dundas, Ont., is having plans prepared for the construction of a high school including chemistry and physics laboratories on King St. Estimated cost $135,000. Equipment will be required.

Laboratory (Medical) — Rockefeller Institute of Medical Research, F. T. Gates, Pres., 66th St. and Ave. A, New York, N. Y., awarded contract for the construction of a medical laboratory at Exterior St. and Ave. A, to Marc Eidlitz & Son, 41 East 42nd St., New York, N. Y. Estimated cost $250,000.

Laboratory (Research)—American Potash & Chemical Co., Trona, Calif., is having plans prepared for a 2 story, 50 x 170 ft. research laboratory, etc. Parkinson & Parkinson, Title Insurance Bldg., Los Angeles, Calif., are architects.

Lead Plant — National Lead Co., 111 Broadway, New York, N. Y., will soon award contract for a 2 story lead plant at Gold and Marshall Sts., Brooklyn, N. Y. William Higginson, 101 Park Ave., New York, N. Y., is architect.

Leather Factory—A. C. Lawrence Leather Co., Crowninshield St., Peabody, Mass., is receiving bids for a 2 story addition to leather factory. Estimated cost $45,000. Private plans.

Lipstick Manufacturing Plant—Kissproof Inc., 3012 Clybourn Ave., Chicago, Ill., awarded contract for a 1 and 2 story, 150 x 183 ft. lipstick manufacturing plant at Cicero Ave. and Pensacola, Hutchinson and Kilpatrick Sts. to Regan Construction Co., 228 North La Salle St., Chicago, Ill. Estimated cost $200,000.

Match Factory—T. Lanctot, City Engr., Hull, Que., is preparing plans for the construction of a match factory. Estimated cost $200,000. Owner's name withheld.

Metal Plant—Carboloy Co., 350 Madison Ave., New York, N. Y., plans the construction of a plant for the manufacture of metal alloys at Schenectady, N. Y. Estimated cost $200,000.

Milk Condensery—City Dairy Co., W. J. Northgrave, Mgr., Spadina Crescent, Toronto, Ont. plans the construction of a 2 story, 50 x 135 ft. milk condensery at Princeton, Ont. Estimated cost $100,000. Gore Nasmith, & Storrie, Confederation Life Bldg., Toronto, are architects. Complete equipment will be required.

Milk Condensery and Powdered Milk Plant—Libby-McNeil & Libby, Merchants Exchange Bldg., San Francisco, Calif., is having plans prepared for the construction of a milk condensery and powdered milk plant at Tracy, Calif. Estimated cost $40,000. Private plans.

Milk Powder Plant Equipment — Elmira Creamery Ltd., Elmira, Ont., prices on complete equipment for milk powder plant. Cost $30,000.

Paint Factory—J. W. Brown Paint Co., Lawton, Okla., is having preliminary plans prepared for the construction of a 1 story paint factory. Estimated cost $50,000. Architect not announced.

Paint Factory Addition—R. N. Nason Co., 151 Potrero Ave., San Francisco, Calif., awarded contract for a 5 story addition to paint factory at Potrero Ave. and 15th St. to K. E. Parker, 135 South Park St., San Francisco, Calif. Estimated cost $100,000.

Paint and Varnish Factory—Flint Paint & Varnish Co., Perth Ave., Toronto, Ont., awarded contract for a 2 and 3 story addition to paint and varnish factory to Anglin-Norcross Ltd, Temple Bldg., Toronto, Ont. Estimated cost $150,000.

Paper Plant — National Carbon Coated Paper Co., Sturgis, Mich., plans the construction of a 2 story, 80 x 200 ft. paper plant. Estimated cost $65,000. Billingham & Cobb, 211 Woodward Ave., Kalamazoo, Mich., are architects.

Paper Plant — Stratmore Paper Co., Woronoco, Mass., awarded contract for a 4 story, 45 x 200 ft. addition to paper plant to L. S. Wood, 14 Stockbridge St., Springfield, Mass. Estimated cost $160,000.

Paperboard Mill — Fir-Tex Insulating Board Co., Portland, Ore., plans the construction of a 100 x 1,400 ft. paperboard mill at St. Helens, Ore. Estimated cost $2,000,000. E. E. and C. A. Millington, Portland, Ore., are industrial engineers. Equipment including six 18 ft. rotary digesters, ten hammer digesters, paper machine, 13 ft. 8 deck dryer, boilers, pumps, engines, etc. will be required.

Rayon Plant—American Enka Corp., A. F. L. Moritz, V. Pres. and Ch. Engr., 114 East 32nd St., New York, N. Y., awarded contract for the construction of a rayon plant in Hominy Creek Valley near Asheville, N. C., to N. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $10,000,000.

Refinery (Gasoline, Oil and By-Products)—Texas Company, West Travis St., San Antonio, Tex., is having plans prepared for the construction of a gasoline, oil and by-products refinery at Cody, Wyo. Estimated cost $250,000. Private plans.

Refinery (Oil)—Empire Oil & Gas Co., Bartlesville, Okla., is having preliminary plans prepared for the construction of an oil refinery, 10,000 bbl. capacity. Estimated cost $400,000. Private plans.

Refinery (Oil), etc.—Empire Oil & Refining Co., subsidiary of Cities Service Co., 60 Wall St., New York, N. Y., plans the construction of an oil pipe line from Ponca City, Okla., to Iowa Refinery, 400 mi. Plans include a large oil refinery in Iowa along the Mississippi River, initial capacity 10,000 bbl., ultimate total capacity 40,000 bbl. Estimated cost approximately $16,000,000.

Refinery (Oil)—Wirt Franklin Oil Co., Ardmore, Okla., is having preliminary plans prepared for the construction of an oil refinery, 1,000 bbl. capacity, near Oklahoma City, Okla. Estimated cost $200,000. Private plans.

Refineries (Oil and Gasoline, Oil and By-Products)—Texas Co., West Travis St., San Antonio, Tex., has acquired a 500 acre site and plans the construction of an oil refinery at San Antonio, also plans gasoline, oil and by-products refineries, at El Paso and Amarillo, Tex., 1,500 and 3,000 bbl. capacity. Estimated cost $2,000,000, $150,000 and $250,000 respectively. Private plans.

Rubber Factory—Canadian Goodrich Co., J. W. Jordan, Mgr., Kitchener, is having plans prepared for addition to rubber factory on King St. W. Estimated cost $250,000. Machinery and equipment will be required.

Rubber Factory—Firestone Tire & Rubber Co., South Main St., Akron, O., awarded contract for the construction of a 4 story factory on Jefferson St., Grand Rapids, Mich., to Owen Ames-Kimball, Pearl St., Grand Rapids, Mich. Estimated cost $100,000.

Rubber Factory—General Tire & Rubber Co., C. J. Jahant, V. Pres., 1708 E. Market St., Akron, O., had plans prepared for the construction of a 2 and 4 story addition to factory. Estimated cost $200,000. Osborn Engineering Co., 7016 Euclid Ave., Cleveland, O., is engineer.

Rubber Factory—Panco Rubber Co., F. Bernstein, Pres., 31 Highland St., Chelsea, Mass., awarded contract for a 2 story, 90 x 100 ft. addition to factory on Highland Ave., to I. Melnicker, 46 Grove St., Chelsea, Mass.

Tar Products Plant—Tar Products Corp., 99 Empire St., Providence, R. I., plans the construction of a plant. Estimated cost $40,000. E. W. Clark, c/o owner, is architect.

Tile Plant—National Tile Co., Anderson, Ind., awarded contract for first unit of tile plant, 1 story, 90 x 415 ft., at 26th and Lynn Sts. to Ethelman & Sons, Anderson, Ind. Estimated cost $75,000. Machinery and equipment including kilns, will be installed.

Yarn Mill—American Bemberg Corp., A. Mothwurff, Pres., 180 Madison Ave., New York, N. Y., plans the construction of third unit of yard mill at Elizabethton, Tenn. Estimated cost $3,500,000.